RUBBER and PLASTICS WEEKLY

VOLUME 141 NO. 15 OCTOBER 7 1961 ONE SHILLING

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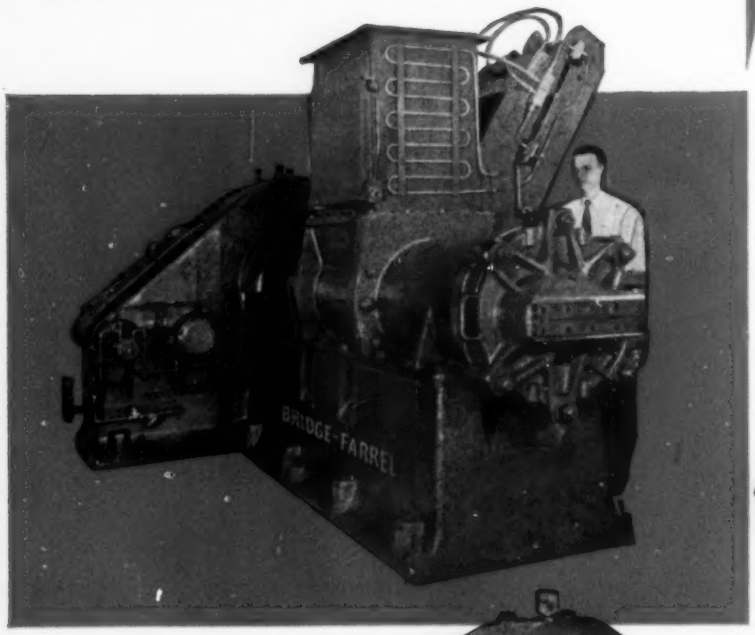

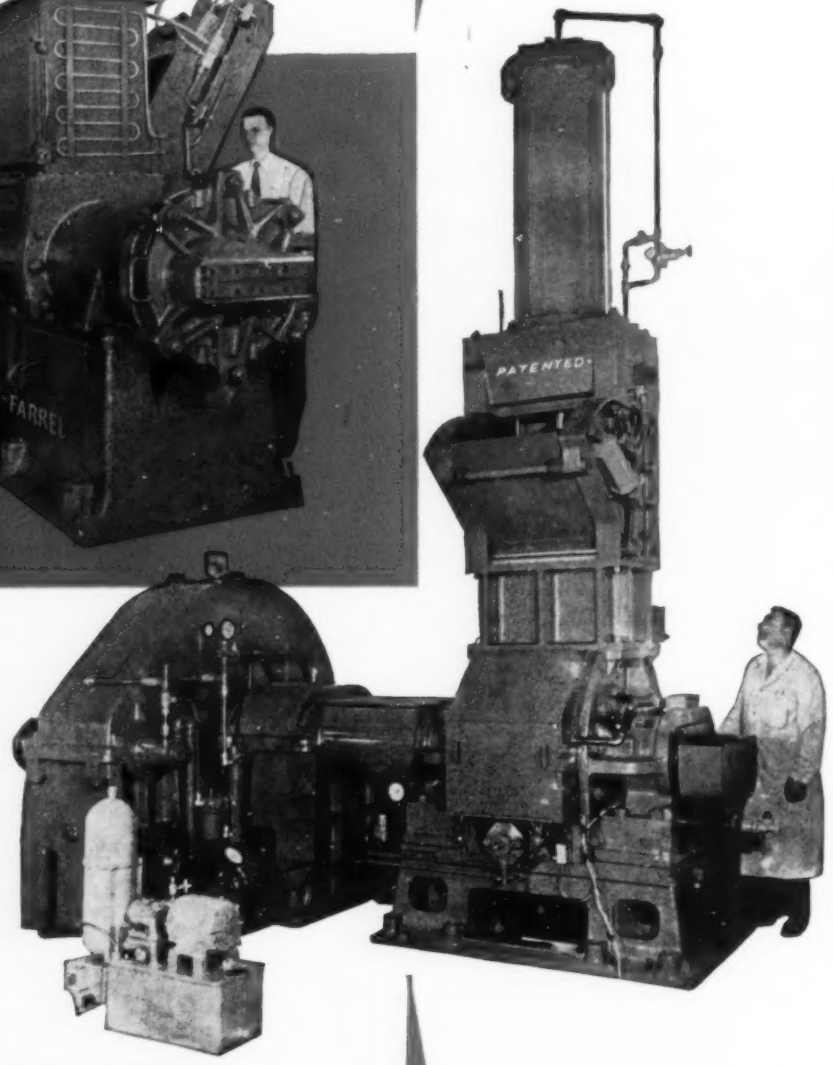

(Illustrated above)

PLASTICS EXTRUDER specially designed to automatically receive and extrude the batch from the BRIDGE-BANBURY MIXER under ideal fully controlled thermal conditions and continuously produce strip or rod form from BANBURY MIXER cycles as low as 2 minutes. Such combinations of machines have been designed and developed for various types of plastics and rubber and are the result of a vast background of experience and factory performance in modern methods of manufacture.

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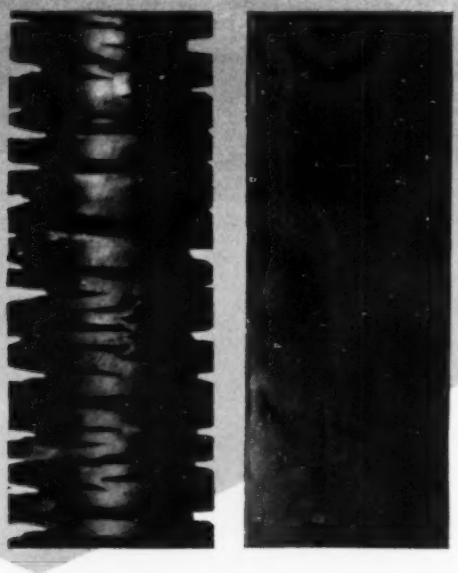
how to increase the useful life of rubber...

Effect of Curing System on Antiozonant Retention in SBR Stocks after Vulcanization

(All contain 3.0 phr UOP 88; 40.0 phr HAF black)

Compound	Accelerator	Sulfur, phr	% Extractable Antiozonant
1082....	2.0 phr benzothiazyl disulfide	2.0	66.4
1083....	1.0 phr benzothiazyl disulfide	2.0	79.6
1087....	None	2.0	~100.0
1088....	1.0 phr benzothiazyl disulfide	3.0	74.6
1083....	1.0 phr benzothiazyl disulfide	2.0	79.6
1089....	1.0 phr benzothiazyl disulfide	1.0	88.6
1083....	1.0 phr benzothiazyl disulfide	2.0	79.8
1084....	1.0 phr N-cyclohexyl-2-benzothiazole sulfenamide	—	—
1093....	1.0 phr diphenylguanidine	2.0	~18.0
1085....	2.0 phr tetramethylthiuram disulfide	—	35.0
1090....	4.0 phr tetramethylthiuram disulfide	—	12.9

The SBR specimens below were exposed to ozone at 100°F with 20 percent elongation for 52 hr. at 33 pphm ozone, then 187 hr. at 63 pphm ozone.



Carbon black—HAF (high abrasion furnace), Curing system—4 phr tetramethylthiuram disulfide; Hours to first crack—7 to 23.

Carbon black—HAF (high abrasion furnace), Curing system—2 phr sulfur, 1 phr N-cyclohexyl-2-benzothiazole sulfenamide. No cracks in 239 hr.

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CONSIDER THE EFFECT OF YOUR CURING SYSTEM ON THE EFFECTIVENESS OF A CHEMICAL ANTIOZONANT

In compounding rubber, there are several things which are important in assuring maximum crack-free life. First, you must use a potent antiozonant like UOP 88 or 288. Next, consider what a vast difference in effectiveness can be realized by your *curing system*.

The right antiozonant used in correct proportion is of primary importance. Then, by using the proper accelerator, you can promote its maximum effectiveness, and thus contribute to maximum ozone protection.

Look at the two rubber test strips illustrated. Both were formulated with UOP 88 . . . but note how much more effectively the antiozonant worked when accompanied by this change in curing systems—a vast increase in resistance to cracking. The table above the test strips shows how the *proper* accelerator aids antiozonant effectiveness.

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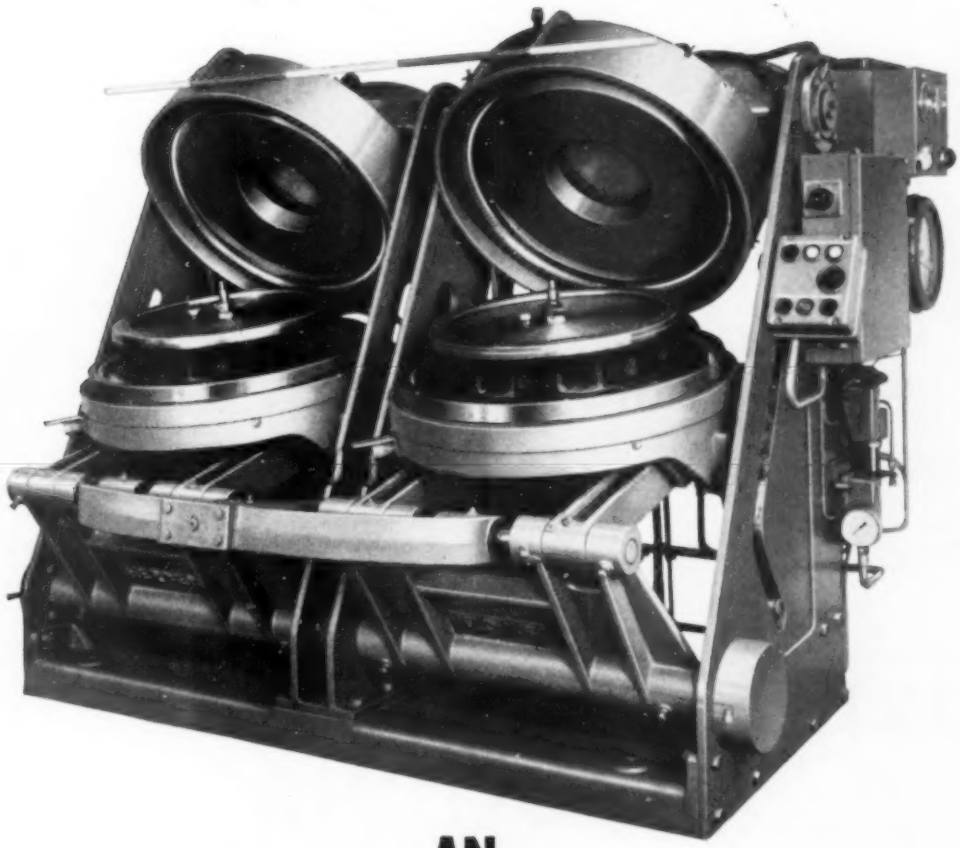

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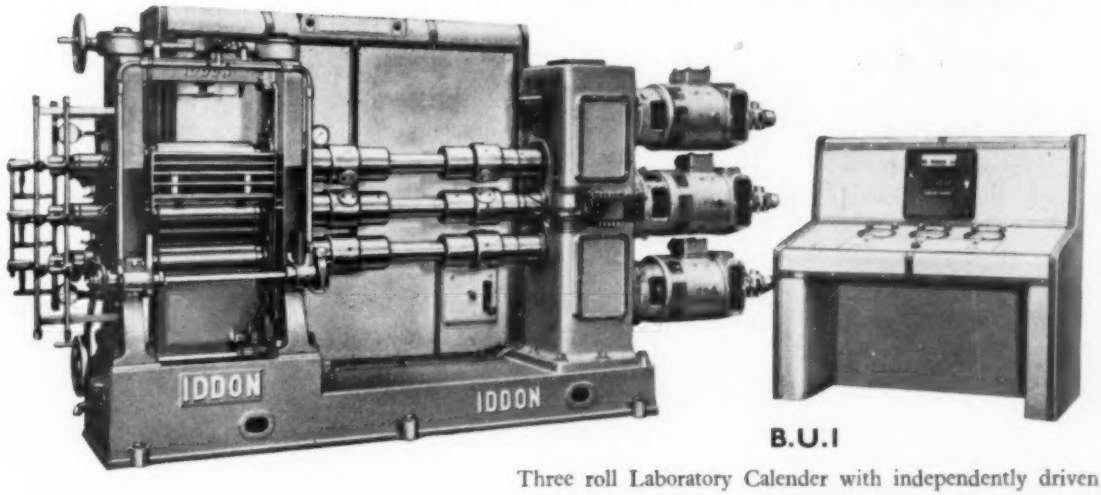

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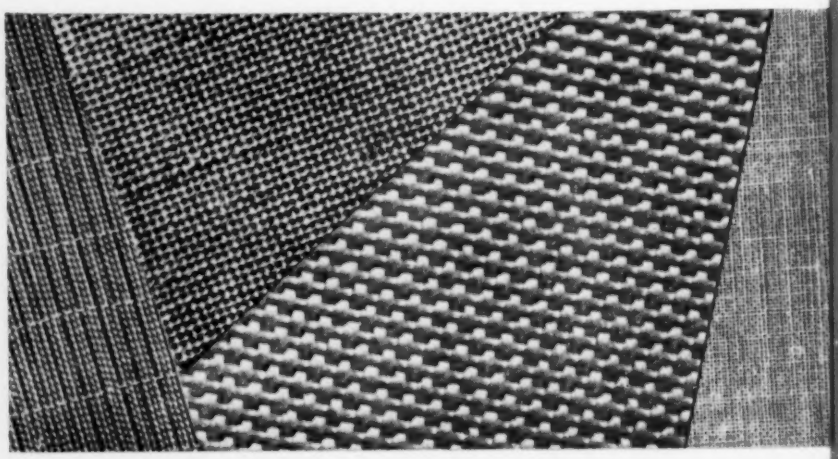

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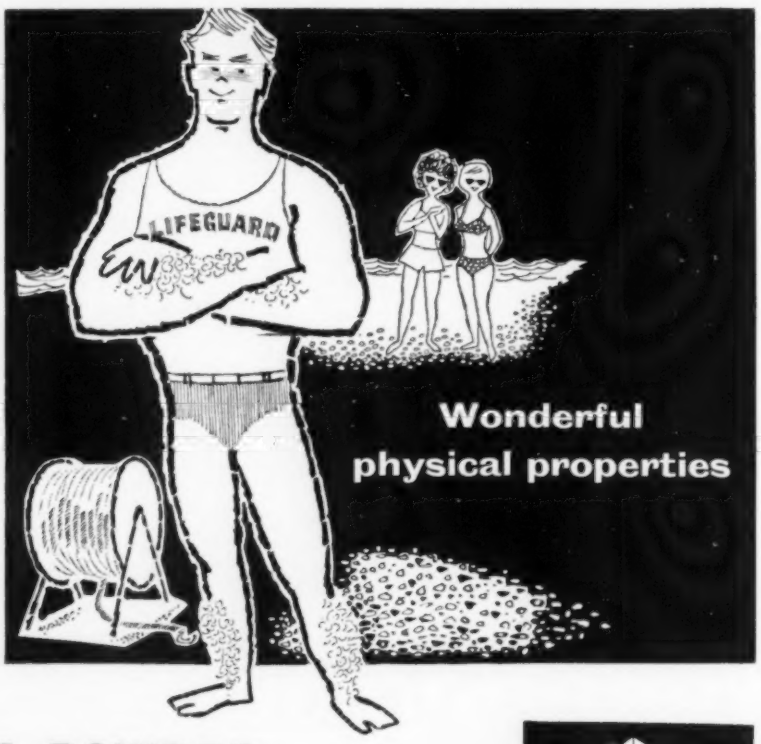

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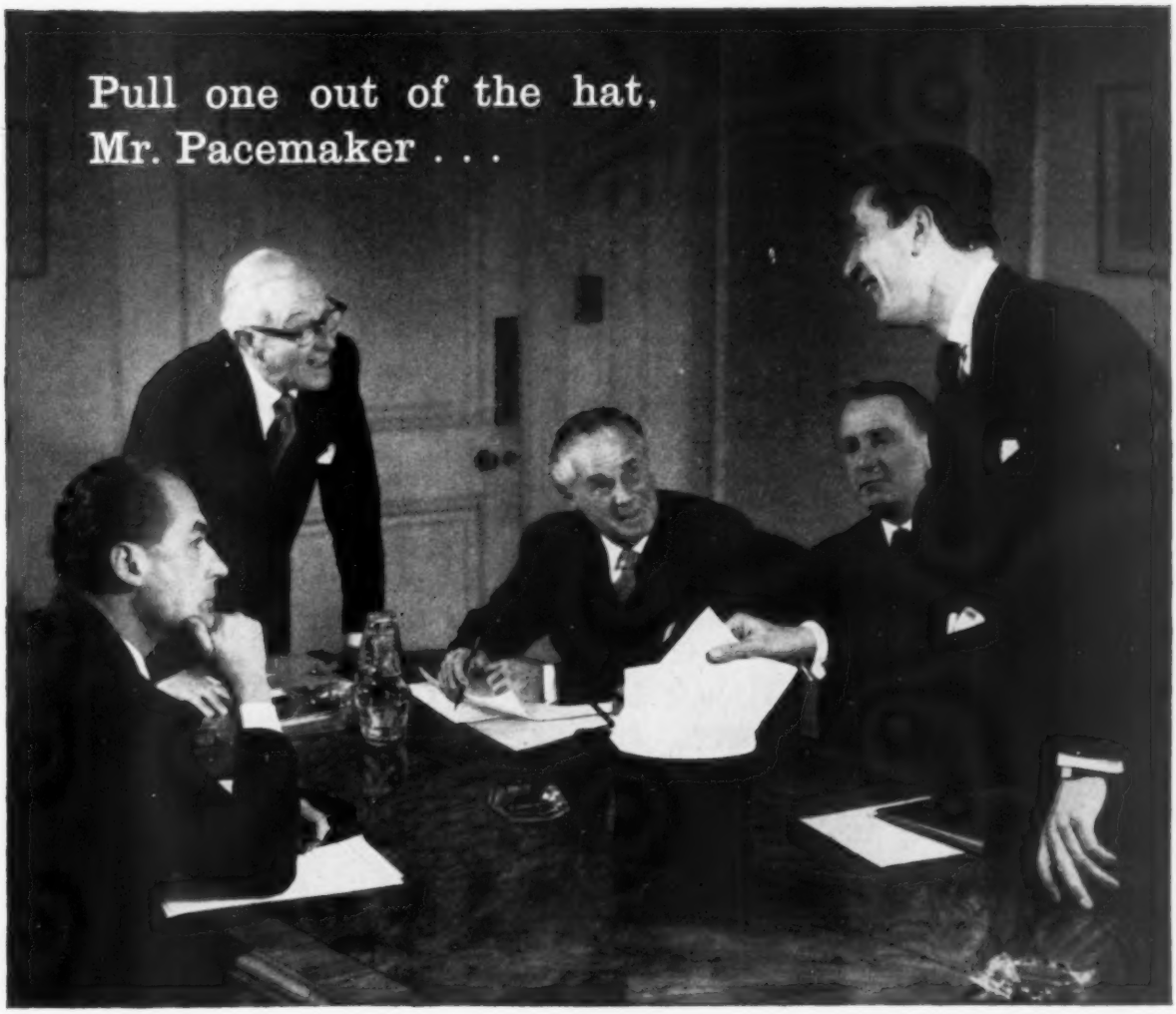

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RUBBER and PLASTICS WEEKLY

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Volume 141 IN ITS 78th YEAR No. 15

October 7 1961

Editorial

NOTES OF THE WEEK 531

Articles and News

NEWS BRIEFS 532
BROCKHOUSE MOVES 533
SUPER OIL SEALS OPEN LLANISHEN PLANT 534
FLUORINATED ELASTOMERS 536
PLASTICIZERS FOR PVC — PART 5 540
IRI GOLF 556

Features

VIEWS AND REVIEWS 544
MEN AND MATTERS 546
THE LEGAL ANGLE 548
PLANTATION NEWSLETTER 551
RUBBER STATISTICS 551
PLANTATION SHARE SURVEY 552
RUBBER MARKETS 553
INDUSTRY INTELLIGENCE 554
SYNTHETIC RUBBER PRICES 555

Classified Advertisements . . . 557 Advertisers Index . . . 560

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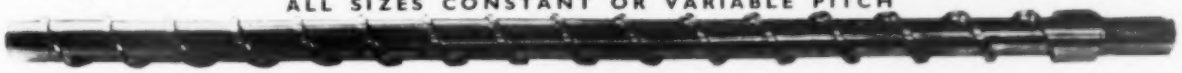

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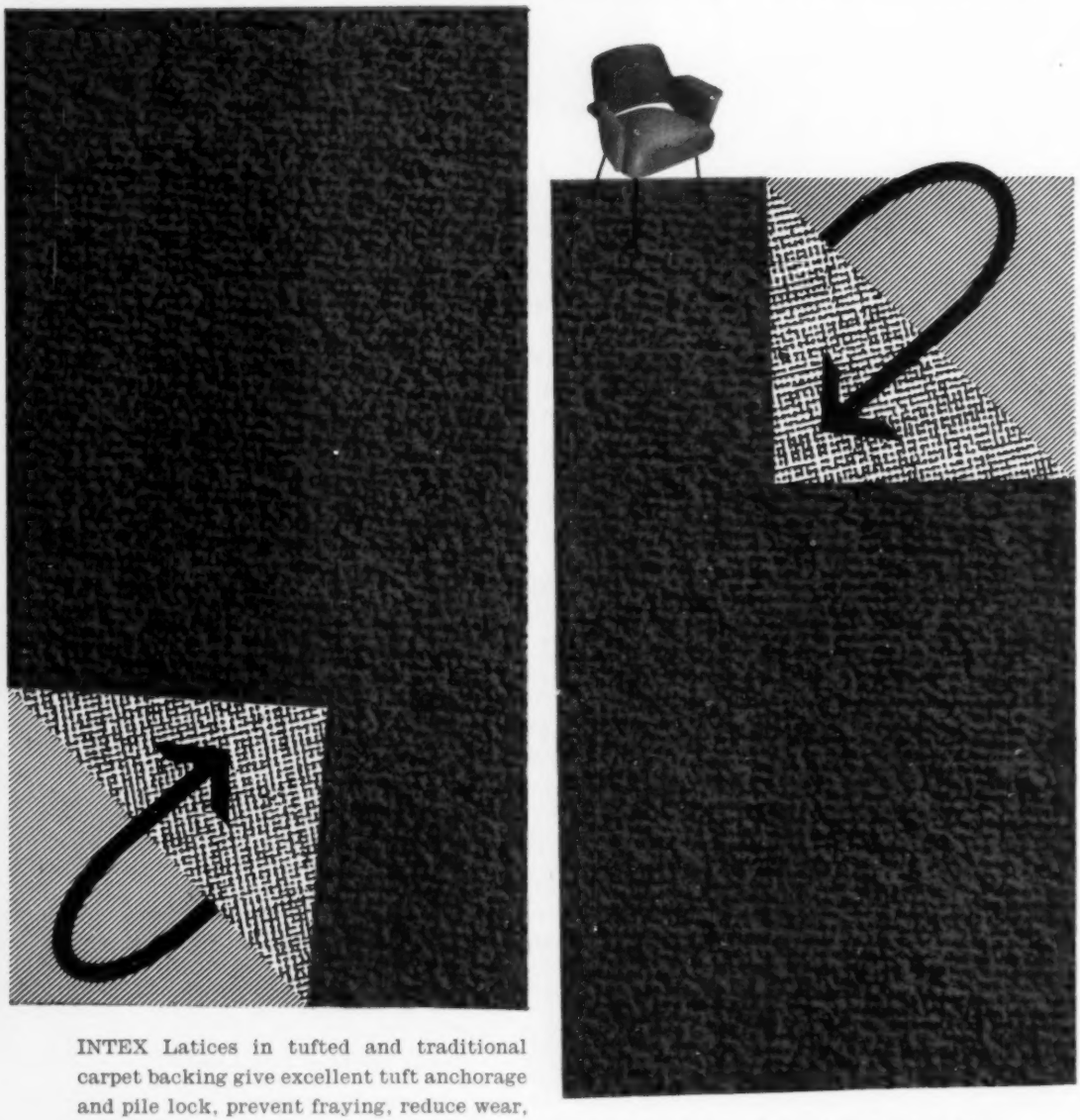

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ISR

NOTES of the WEEK

Production and Consumption

ONE analysis of the many factors affecting the supply and consumption of rubber indicates that there will be a fairly sizeable production surplus of natural by the end of 1961.* Although consumption in the second half of the year will probably be higher than in the first six months, the seasonal and long-term increase in production looks like being more than ample to cover this increase in demand. Natural consumption in USA in this latter half of 1961 should increase — but will obviously feel the effect of the sales of stereospecific rubbers. Predictions in this sector are difficult, because of the lack of reliable statistics. It should now be possible for total US stereo sales figures to be made available in the same way as the figures for SBR and other 'traditional' synthetics are available.

However, over the whole year world consumption of natural should be just under 2m. tons and production just over this figure. The net result should be a surplus of about 50,000 tons. This will probably mean that the price of natural will persist in remaining at the level it has kept to fairly steadily over the past six months — around 25d. a lb. — possibly with a slight downward tendency. The downward pressure of prices may also be felt by the general-purpose synthetics.

The Butyl Market

IN a special report *Rubber Trends* analyses the structure of the world butyl market and in an appraisal of prospects concludes that these are much brighter than has generally been thought. But it points out that producers' expansion plans, which seem to be contemplating a world consumption in the region of 250,000 tons by 1964/65 (as opposed to 136,000 tons in 1960) appear unduly optimistic. Another report deals with past and likely future production trends in low-grade and high-grade natural. It concludes that, although low-grade rubber will continue to decline in relative importance, partly as a result of increased production of high-quality estate rubber, it is not certain whether this will significantly alter the pattern of world supplies by 1965. A future shortage of low-grade rubber would depend on a fall in supplies from Indonesia rather than on long-term production trends elsewhere.

*Rubber Trends. Published by the Economist Intelligence Unit.

Stock Characters

THE media of mass communication, through which everything is brought down to the lowest common denominator, tends to force all humanity into a series of stock characters. All film stars are glamorous; all scientists have heavily-domed foreheads and wear spectacles as they bend over bubbling reaction mixtures; and all business executives eat too much and are liable to ulcers and heart attacks. How misguided is this popular picture of a business executive is shown by an extremely interesting three-year study of 89,000 employees recently completed by two members of Du Pont's medical division in USA. The two men — Dr Sydney Pell, a biostatistician, and Dr C. A. D'Alonzo, assistant medical director — say, in fact, that heart attacks occur more frequently in lower-paid male employees than they do among those whose salaries and responsibilities are greater.

Writing in the *Journal of the American Medical Association*, the specialists say that, during the three-year period, 653 employees had a first heart attack. The incidence rate was much greater in men than in women, but the differences between the rates decreased with increasing age. Only 5.4% of the patients were subjected to more than average physical stress when the attack came on. The case fatality rate was 31.4% and the probability of survival decreased as age increased.

The incidence of heart attacks was lowest among the highest salary group: 2 per 1,000 people per year. In the next highest group the rate was 2.4 per 1,000. In the two lower-salaried groups the rates went up to 3.8 and 4.0 a 1,000. The rate for the weekly-paid workers — the most physically active — was 2.9 a 1,000.

Does this mean that it is safer at the top? Hardly. The stresses and strains are obviously greater the higher an executive climbs. The Du Pont specialists give a more plausible explanation of the statistics. They feel that possibly the ladder to the top itself carries out the statistical selection: for greater responsibilities the better adjusted individual will tend to be chosen, and for the very reason that he is better adjusted he will be more able to cope with the stress of life — and less liable to suffer a heart attack.

NEWS *Briefs*

RUBBER SHIPMENTS TO RUSSIA — AUSTRALIAN TITANIUM DIOXIDE PLANT — FORMICA'S SALES MANAGER IN HUNGARY — DU PONT VINYL RESIN

●**South Africa** — The South African Industrial Development Corporation is considering the financing and building of a large synthetic rubber factory at Sasolburg, in the Transvaal. Rubber would be produced mainly for South African-made tyres, but also possibly for export.

●**United States** — The Firestone Tire and Rubber Co. does not expect tyre prices to rise during the rest of this year. At the same time, 'the effects of wage increases and high costs of materials eventually will push our prices up', according to Earl B. Hathaway, vice-president of sales. Mr Hathaway was speaking at a Press conference at the 41st convention and trade show of the National Tyre Dealers and Retreaders Association in Cleveland. During 1961, about 70.5m. replacement passenger tyre units will be shipped, and it is estimated that in 1965 some 80m. units will be shipped, he said. Passenger tyre retreads will total almost 30m. units this year and will climb to 34m. by 1965, he predicted.

●**Poland** — Nigeria will sell rubber, among other goods, to Poland under a trade agreement signed in Warsaw recently. Poland will provide consumer goods, sugar, cement, ships, machinery, oil refining equipment and a cement factory. The total value of the agreement — the first between the two countries — is understood to be several million £ sterling.

●**Malaya** — Malaya is 'actively studying' the question of its Central Bank issuing its own currency. At present, Malaya has a common currency with Singapore and Borneo.

●**India** — A consignment of 16in. bore rubber and rayon wire-bound hose will shortly be shipped to Calcutta. This hose was supplied by BTR to Burmah Oil Pipelines Ltd. for Oil India's 700-mile long pipeline project which, when complete, will carry crude oil from Nahorkatiya, Assam, to Government refineries at Gauhati and Barauni.

●**Australia** — Laporte Titanium Ltd. has awarded to the Bechtel Organization (Bechtel Pacific Corp. Ltd., Melbourne; Bechtel International Ltd., London) the overall contract for engineering and construction of the titanium oxide plant to be built for them at Bunbury in Western Australia. The plant is designed to produce 10,000 tons of titanium oxide pigment a year, the major portion of which will be shipped to the Eastern States of Australia to supply the growing demand for the pigment by the plastics, rubber and other industries.

●**Indonesia** — The trans-shipment of Indonesian goods, by foreign purchasers, to the Netherlands, has been stopped by the Government. A new order has been issued by the Foreign Exchange Institute, as a follow-up to the Government action abrogating all relations with the Netherlands. This states that the Institute will not deal with foreign currency exchanges in which the first buyer abroad re-sells to buyers in the Netherlands.

●**Singapore** — Several large shipments of rubber for Russia are in course of loading. The charter steamer *Aristoteles* has just finished loading 8,500 tons and the *Labinsk* is beginning to load 7,000 tons, which will not be recorded in the September export returns. The *Yuri Gagarin* arrives early this month in Penang to ship an estimated 14,000 tons.

●**Switzerland** — A new vinyl resin has been introduced on the European market by the agricultural and industrial chemicals department of Du Pont International S.A. This product, a copolymer of ethylene and vinyl acetate is used to impart toughness, flexibility and adhesion to paraffin wax and other low molecular weight materials. It is expected to increase the use of wax in the packaging, paper-making and adhesives industries.

●**S. Rhodesia** — Inauguration ceremonies following the complete modernization of Vitafoam's associate company in Bulawayo will take place this month. Since Vitafoam Ltd. acquired an interest in Perman-Air Ltd., the plant has been entirely replanned and re-equipped with plant built by Vitafoam in their Lancashire works. Norman Grimshaw, chairman of the company, flew to Rhodesia for the ceremony on October 6.

●**Hungary** — The export sales manager of Formica Ltd., Gordon Tozer, is on a visit to Hungary and Czechoslovakia. He hopes to visit the State Government buying agencies in both countries in the hope of obtaining substantial orders for Formica industrial laminates. Formica laminates are already widely used in Hungary and Mr Tozer hopes to repeat last year's bumper order and to enjoy the same success in Czechoslovakia.

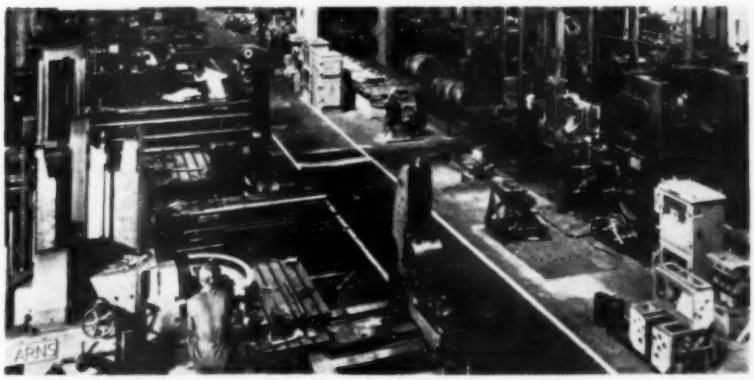
'21 years without a strike? We must have been overpaying them all that time!" — 557

Brockhouse Moves

PLASTICS INTERESTS GO TO MANCHESTER

THE Brockhouse group has transferred the manufacture of its injection moulding machines from Wolverhampton to Manchester.

and Co. Ltd. F. V. Bird, who has had 15 years' experience in the injection moulding field, has joined the company as technical sales engineer.



Part of the 70,000-sq. ft. factory of J. Brockhouse and Co. Ltd. at Saxon Street, Denton, Manchester, where Lester injection moulding machines are now being manufactured

The plastics activities of the Brockhouse organization, which are at present concerned with the manufacture of injection moulding machines, have been wholly transferred from its Penn Road, Wolverhampton, factory, to Denton Works, Saxon Street, Denton, Manchester.

The Wolverhampton works will continue to deal with general machining work and machine tool manufacture and rebuilding.

A. Boardman has taken over the joint responsibilities of technical and sales manager of the plastics manufacturing division of J. Brockhouse

He will operate in the southern region from the organization's London office at 25 Hanover Square, W.1.

The Denton Works has a manufacturing area of some 70,000 sq. ft. with five acres of land available for extensions.

NRPRA Symposium

The Natural Rubber Producers' Research Association is holding a symposium on 'Fundamental and Practical Approaches to Ageing Protection' at its laboratories at Welwyn Garden City on November 2 and 3 this year.

Subjects of the papers are fundamental approach to a study of ageing; ageing characteristics of different vulcanizates; developments in the use of vulcanization activators for latex systems to give (a) high temperature resistance and (b) elimination of copper staining; flame-resistant natural rubber latex compounds; protection of natural rubber compounds against ozone cracking and some factors influencing creep and fatigue.

Attendance will be by invitation only.

Tyre Price Cuts

Reductions in tyre prices, effective from October 2, have been announced by many of the leading manufacturers including Avon, Dunlop, Firestone, Goodyear, India, Michelin and Pirelli. Tyres for cars, commercial vehicles and for agricultural use came down by approximately 6%, while earthmover, barrow and trolley tyres are now 3% cheaper.

Dunlop, announcing its reductions, said that trading margins allowed to distributors would be reduced appropriately. The company said that the changes would serve two purposes. They would relieve the anomalies that existed in the present distribution price structure and would bring trading policies and prices more into line with continental practice.

As examples of the new prices — Dunlop Mini sizes are reduced from £5 9s. 6d. to £5 2s. 6d. — Michelin X 5.20-13 from £5 14s. to £5 7s.

The cuts are partly a recognition of the reductions being made by retailers in an effort to attract trade and partly the result of increased manufacturing efficiency and lower rubber costs.

21997

Novadel Ltd. of London, S.W.18, has installed Telex. The number is 21997 and the 'answer back' code Novadel London.

Sarnia Operating at Absolute Capacity

CROWN-OWNED synthetic rubber producer, Polymer Corporation, of Sarnia, Ontario, is operating at absolute capacity, reports *RPW*'s Canadian correspondent from Montreal. Production and sales are running ahead of last year and will establish new records again this year.

According to company sources production is being squeezed out at a maximum of existing plant facilities. The need for expanded plant is getting more pressing all the time, it is stated.

Location of a projected new multi-million dollar butyl plant is expected to be announced soon, and it is no secret that a site in Belgium, inside the European Common Market, is being considered, along with other locations both overseas and at home.

New Speciality Plant

Construction is already well under way on the new $12m. speciality rubber plant at Strasbourg, France. The plant will be completed about this time next year. Completion of these two new plants will take a big load off existing Sarnia facilities and permit a sizeable jump in output.

Two other major projects are enlargement of butadiene extraction facilities at Sarnia, which will be completed by the end of this year, and the new $8m. to $10m. plant to make polybutadiene rubber. Scheduled for production late next year, this plant will have a capacity of 20,000 tons a year.

Playtex Expansion

Playtex Ltd., foundation garment manufacturers, of Port Glasgow Industrial Estate, are shortly to occupy a third factory on this estate. The 83,000 sq. ft. unit is the largest on the site and will employ an additional 500 workers.

Compounding Ingredients Ltd.

Compounding Ingredients has moved to Cromford House, Cromford Court, Market Street, Manchester 4. The new telephone number is Deansgate 3035/6.

Super Oil Seals Opens Llanishen Plant

LARGEST HIGH PRESSURE HOSE FACTORY IN EUROPE

Aerial view of Super Oil Seals Llanishen factory

THE productive area of Super Oil Seals and Gaskets Ltd. was doubled on Wednesday (October 4) with the official opening of its new factory at Llanishen, Cardiff. It is said that the new factory, when in full production, will be the largest high pressure hose manufacturing plant in Europe.

Among those present at the opening ceremony were the Rt. Hon. Lord Brecon, Minister of State for Welsh Affairs, the Lord Mayor of Cardiff, Donald Box, MP (Cardiff North), H. E. Cressman — founder of Super Oil Seals and Gaskets, and R. W. Roberts, chairman of the company.

American Patent

Super Oil Seals and Gaskets Ltd., a leading manufacturer of oil seals and high pressure hose, was founded in 1932 by Harry E. Cressman. Mr Cressman had acquired the European rights on an American patented oil seal. He first set up his business in small premises in Birmingham. The seal was so well received and the business grew so rapidly, that it was necessary to move to larger premises four times in four years.

At this time the company, now well established in its main factory at King's Norton, Birmingham, was floated as a public company under the chairmanship of the late R. Hugh Roberts, a leading Midland industrialist and father of R. W. Roberts, the present chairman of the company.

Since 1935 the company has been using synthetic rubber, first in oil seals and later in high pressure flexible hose, and was one of the pioneers in the use of this material in the UK.

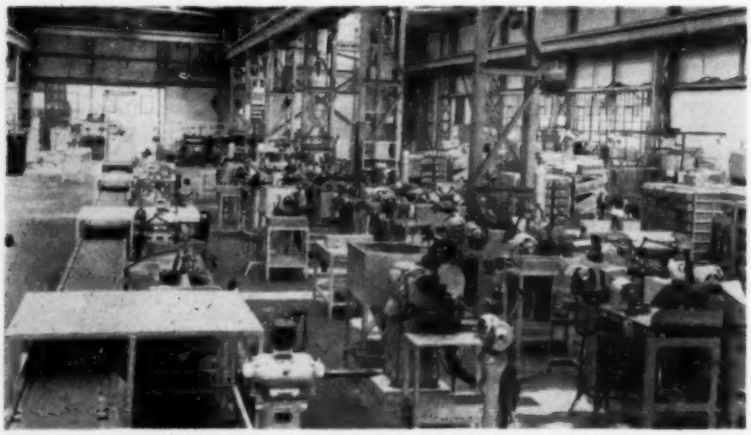
In 1944, at the request of the leading aero engine builders in the country, Super Oil Seals began to produce flexible hose lines. The rapid success of this venture, coupled with an unprecedented demand for oil seals, hydraulic packings and other products, soon meant that once again more factory space was required.

Consequently, in 1951, part of the plant was transferred to a new modern factory at Western Avenue, Cardiff. This factory, which was on lease, occupied a floor area of 60,000 sq. ft. with — apparently — ample room for expansion.

The 60,000 sq. ft. factory at Western Avenue at first housed some 100 employees and by the end of 1953 this figure had risen to 350. By 1959 all the factory space — which had been increased to 85,000 sq. ft. — was occupied and the labour force had risen to approximately 800. But the demand for the company's synthetic rubber products continued to shoot up — leading to the purchase of the Llanishen factory.

The immediate productive area of this plant is 270,000 sq. ft. which, with the addition of new equipment to that transferred from Western Avenue has promptly doubled the company's productive capacity. Even so, the total area of 34 acres will enable the existing factory floor space to be trebled.

Between the years 1952 and 1960 production increased by five times; the Llanishen works offers a potential expansion of ten times that achieved at Western Avenue. The expansion has included a considerable increase in export sales.



One of the oil seal trimming departments at Llanishen

P. B. Cow Expands

Further facilities for the expansion of the plastics side of the P. B. Cow group of companies have been announced by the directors.

They are in the process of completing negotiations for the acquisition of the entire share capital of British Artid Plastics Ltd. for the sum of £25,000.

The British Artid factory adjoins the premises of London Moulders (Plastics) Ltd., one of the P. B. Cow subsidiaries and the companies are engaged in similar business.

Philback I Cheaper

Philblack Ltd. has announced reduced prices for its Philblack I ISAF carbon black, which became effective on September 27.

The new prices are: min. 3 ton lots, 9½d. per lb., ex works; less than 3 tons, 9¾d. per lb. ex works; min. 50lb. bag, 10½d. ex store.

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Fluorinated Elastomers

SPECIALIZED HIGH-PRICE HIGH-PERFORMANCE MATERIALS

By D. C. MILES, API*
Visiting Lecturer, National College of Rubber Technology

THE rapid growth of polymer science and technology is resulting in the discovery of materials with new and unique properties. These properties are readily being utilized by specialized industries such as the aircraft (including missile and rocket), car and chemical industries. Their requirements are for an elastomer combining the good physical properties of conventional organic elastomers with the high thermal stability of the inorganic materials.

These many requirements are met, to a large extent, by the fluorine containing elastomers, although the ideal elastomer has yet to be marketed. This family of elastomers are mostly used by the above specialized industries and their high cost somewhat restricts their use in other industries.

Typical fluorine containing elastomers are the vinylidene chloride/hexafluoropropylene copolymers, fluoro-silicones, fluoro-acrylates and other fluorine substituted elastomers.

Vinylidene Chloride/ Hexafluoropropylene Copolymers

Vitons

This group of elastomers have aroused a great deal of interest over the last few years. Their outstanding physical properties have been readily seized and utilized by the specialized industries. The Vitons exhibit a combination of heat and oil resistance obtainable from very few elastomeric materials.

Early attempts to convert the base gum to a useful cross-linked product using a peroxide curing system were not completely successful. It was not until products produced using an amine curing system that the full potential of this family was recognized.

The copolymers are prepared from vinylidene fluoride and hexafluoropropylene by emulsion polymerization at temperatures up to 100°C. using a redox initiation system (a persulphate/bisulphite combination). The elastomer is obtained initially as a latex and this is coagulated normally by adding sodium chloride or hydrochloric acid. The resulting product is a white powder which on drying and pressing becomes clear.

It is generally agreed that cross-linking takes place through a preliminary elimination of hydrogen fluoride from the polyvinylidene fluoride segments.[1]

$$\left[-CH_2-CF_2-CH_2-CF_2-CH_2-CF_2-CF_2-CF(CF_3)- \right]_n$$

Molecular weight is in the region of 150,000.

With the liberation of hydrogen fluoride it becomes obvious that an acid acceptor must be added and magnesium oxide has proved most suitable.

The most common examples of curing agents are the carbamate and biscinnamylidene derivatives of hexamethylene diamine. The most popular being hexamethylene diamine carbamate and ethylene diamine carbamate.

Without the addition of magnesium oxide or other similar basic materials, none of the known curing formulations will work. The heat ageing characteristics of the elastomers will vary according to the type of magnesium oxide used and it has been reported that Maglite K (made by Merck and Co. Inc.) gives superior properties.[2]

The material, not only is given a press cure of 10-50min. at 145°C., but must be post-cured at 200°C. for 10-24hr. in order to complete cross-linking and to obtain maximum physical properties.

Typical curing systems that have been used for curing the Vitons are listed below.[1]

Curing System	*Characteristic*
1. Thermal	Slow
2. Radiation	Impractical
3. Peroxides	Inefficient (low state of cure)
4. Dithiol/tertamine	Good (except for high temp. ageing)
5. Diamines	Good (but scorchy)
6. Diamines-inner salt	Good commercial system

Properties of the following vinylidene fluoride / hexafluoropropylene compound are given in Table 1.

Viton A	100
MT black	25
Maglite K	20
HMDA—carbamate	1.3

Press cure 30min./300°F. followed by 1hr/212°F., 250°F., 300°F., 350°F. and 24hr. at 400°F.

It can be seen from Table 1 that the air ageing and oil-resistant properties of the Vitons are excellent. These elastomers provide excellent heat stability and resistance to a wide variety of chemicals and fuels. The tear strength at elevated temperatures could be better and some fluids tend to act as mild plasticizers at these higher temperatures.

A future development of this family may well be that of a room temperature curing system. This material would be an ideal caulking, sealing and potting compound. If the new material were to retain the family fuel resistance it would then become highly competitive to materials like the cold-curing silicone rubbers and the polysulphides. This material would not have much better fuel resistance than the polysulphides, but the smell would be less obnoxious.

Fluorel

This is another copolymer of vinylidene fluoride and hexafluoropropylene and as a fluid resistant fluorocarbon elastomer it is becoming very important to many industries.

The base material may be cured to a suitable elastomer by organic amines, peroxides and controlled dosages of irradiation. The most suitable curing agent is probably hexamethylene diamine carbamate. The mix must be stabilized during cure and it is necessary to add magnesium oxide which provides good protection against heat degradation. Zinc oxide and dibasic lead phosphite may be used as alternatives.

The base material can easily be compounded on conventional rubber machinery and can be fabricated by normal methods, such as extrusion, calendering, etc. In curing, it is normal to give the elastomer a press cure of 1hr. at 300°F. followed by a final post-cure of 24hr. at 400°F. The following compound given a cure of this nature has properties as shown in Table 2.[3]

Fluorel	100
Magnesium Oxide ..	20
Carbon black (Thermax)	15
HMDA—carbamate	1

**Mr Miles was formerly with Midland Silicones Ltd.*

TABLE 1
VITON PROPERTIES AFTER AIR AGEING AND OIL IMMERSION

	Original	*Air*	*ML* 08200*	*ASTM Ref. Fuel B*
Temperature, F.	RT	600	400	RT
Time, hrs.	—	16	72	72
Tensile strength, psi	2,220	−29%	−16%	−4%
Elongation, %	220	−31	−25	0
Hardness Shore A	73	+11	−1	−1
Volume Change, %	—	—	4.2	2.4

*ML 08200 is a silicate ester oil.

TABLE 2
FLUOREL PROPERTIES AFTER AGEING AND OIL IMMERSION

	Original	*MIL* 0-8200	*MIL*-0-7808	*Red Fuming Nitric Acid*	*Benzene*
Time, days	—	7	7	7	7
Temperature, F.	RT	300	400	77	77
Tensile strength, psi	2,300	2,400	2,180	1,020	1,980
Elongation, %	320	340	265	520	300
Hardness Shore A	65	60	59	66	49
Volume Swell, %	—	+3	+12	+64	+22

It can be seen from Table 2 that Fluorel exhibits excellent resistance to a wide range of fuels and solvents. Of particular interest is its stability to most lubricants and hydraulic fluids used in the aircraft industry. This elastomer has excellent low temperature properties, although stocks tend to stiffen at 0°F. but the elastomer may be bent over a mandrel at −50°F. without cracking.

The material has been submitted to many stringent tests and it is particularly resistant to weathering and ozone.

The above properties make this material highly desirable to many industries.

Fluorocarbon Elastomer 214

This material is yet another saturated fluorocarbon elastomer containing 70% of vinylidene fluoride.

The elastomer may be cured by using a variety of materials including peroxides, amines and hexamethylene diamine carbamate. A typical peroxide used is benzoyl and the amine is triethylene tetramine. An acid acceptor is required during the curing reaction and it is normal to use magnesium or zinc oxide.

Elastomer	100
Hi-Sil 202 (Silica filler)	10
Zinc Oxide	5
Dyphos (dibasic lead phosphite)	10
HMDA—carbamate	2

Press cure 30min. at 320°F. Oven cure 16hr. at 350°F.

This material exhibits all the usual properties now associated with the fluorocarbon elastomers. The oil, fuel and chemical resistance are excellent. It can also be seen from Table 3 that the resistance of this elastomer to oxidizing agents, such as red fuming nitric acid, is excellent.

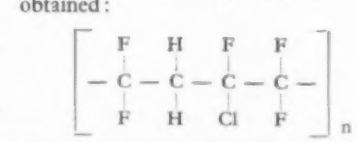
These copolymers are finding many applications in industry and the following are but a few: 'O' rings, oil seals, gasket and hoses, chemical tank linings, sleeving, oil and chemical resistant rubber rollers and coated fabrics for protective clothing.

Vinylidene Fluoride/ Chlorotrifluorethylene Copolymers

These copolymers are known under the name of the Kel-F elastomers. They are derived from the emulsion polymerization of chlorotrifluorethylene (CF_2=CFCl), a monomer obtainable by dechlorination of CF_2 Cl $CFCl_2$ (a common refrigerant). Resemblance in certain respects to polytetrafluoroethylene is obvious in being rigid, but when they are shock cooled from the melt they are almost glass clear and possess inferior heat stability.

On copolymerizing chlorotrifluorethylene with vinylidene fluoride, hydrogen atoms are introduced into the chain and the polymer is no longer rigid but flexible.

The following structure is obtained:



Kel-F Elastomer 5500

This material is a 50/50 copolymer of vinylidene fluoride/chlorotrifluorethylene and was the first material of the group to be developed. It has excellent resistance to strong oxidizing agents, such as nitric and sulphuric acid and is also resistant to hydrocarbon fuels and ozone. This elastomer has been extensively compared with commercial conventional synthetic elastomers as shown by Table 4.

This material also has excellent flame retardant properties and would appear to be an excellent all-round material. Unfortunately, it possesses certain disadvantages including poor resistance to compression set at elevated temperatures and fabrication difficulties in producing such items as 'O' rings and gaskets. These difficulties provide the vinylidene fluoride/hexafluoropropylene copolymer elastomers with opportunities to replace the Kel-F materials due to their better properties.

Kel-F Elastomer 3700

This is a copolymer of 30% chlorotrifluoroethylene and 70% vinylidene fluoride and is competitive with the other Kel-F elastomers, but is still essentially a high price material. This particular material possesses marginally better low temperature flexibility and resistance to hydrocarbon fuels than Kel-F 5000.

TABLE 3
PROPERTIES OF FLUOROCARBON ELASTOMER 214[4]

	Original	*Air*	*MIL*-0-7808 (*Turbo Oil* 15)	*MLO*-0-8200	*Red Fuming Nitric Acid*
Time, hrs.	—	70	70	70	6
Temperature, F.	RT	400	400	400	75
Tensile strength, psi	1,710	1,700	1,770	1,630	1,360
Elongation, %	265	310	325	270	275
Hardness Shore A	65	66	59	66	60

SWELLING IN OIL AFTER IMMERSION FOR 48HR. AT 75°F.

	% *Swell*
Fluid III (70/30 mixture of Iso-octane/toluene)	0
SAE 50 Motor Oil	−1%
MIL-0-7808 (Turbo Oil No. 15)	−2%
MLO-8200 (Silicate ester)	0

The Kel-F elastomers may be cured by peroxide or organic amines. These materials must be given a post cure in addition to the press cure in order to obtain maximum physical properties. This group of elastomers can be moulded, extruded, and calendered with normal rubber processing machinery.

Kel-F Elastomer	100
HMDA—carbamate	4.5
Zinc Oxide	10
Dibasic lead phosphite	10

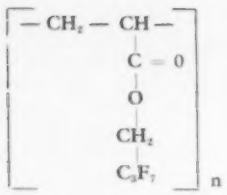
Pressure 30min. at 350°F. Post cure 16hr. at 350°F.

Fluoro Acrylate Elastomers

Poly FBA

This is the best-known elastomer of this group and is poly 1,1-dihydroperfluorobutyl acrylate. It may be represented as shown overleaf.

This material may be cured by certain metallic oxides or aliphatic



amines and reinforced with carbon black.[5]

Poly FBA can be processed on conventional rubber machinery and exhibits good rubbery characteristics. It has excellent resistance to many fuels, lubricants, solvents, chemicals and ozone plus very good stability at high temperatures. Some typical properties of the following compound are given in Table 6.

Poly FBA	100
Triethylene tetramine	125
Sulphur	1
Stearic acid	1
SAF Black	35

Cure 60min. at 310°F.

TABLE 6
PROPERTIES OF POLY FBA

	Original	*Diester-based Jet Engine Oil MIL-L-7808*
Temp. °F. ..	RT	350°F.
Time, hrs. ..	—	500
Tensile strength, psi	1,390	1,020
Elongation, % ..	390	250
Hardness Shore A	63	75

Unfortunately, this elastomer has a brittle point in the region of −25°C. and its usefulness is limited to −20°C. although it retains its elasticity down to the brittle point. Subsequent development of superior special purpose high temperature elastomers has resulted in the rapid decline in the usefulness of the fluoro acrylates.

Other fluoroacrylates which cannot be discussed due to space limitations, include Fluoro-Rubber 2F4, which is per fluoromethoxy-1, 1-dihydro-per-fluoropropyl acrylate.

Fluorinated Silicones

Silicone rubber resembles the natural and synthetic elastomers in many ways. It can be stretched or deformed and exhibits the characteristic flexibility and resilience associated with organic rubbers. The most important property of the silicone group of elastomers is their ability to remain serviceable for long periods at temperatures as low as −70°C. (where other elastomers become hard and brittle) and as high as +250°C. where organic rubbers tend to char and melt. The deficiencies of this group of elastomers include their relatively poor resistance to aircraft fuels, hydraulic fluids and certain solvents.

It was with this fact in mind that fluorine containing substituent groups have been introduced into the polysiloxane polymers. This provides elastomers with superior resistance to the swelling effects of many solvents as can be seen from Table 8. The early fluorinated silicone rubbers available (*viz.* Silastic LS53) were much more difficult to process than the unmodified silicone rubbers, but a fluorinated silicone rubber (Silastic LS63) is now available in the USA and in the UK which can be processed as easily as unmodified silicone rubber.[6]

These elastomers may be cured by peroxides and they also require a press cure followed by a post cure.

Properties of stock after curing[7] — Press cure 5min. at 115°C. followed by post cure 8hr. at 200°C. — are shown in Table 7.

TABLE 7

Tensile Strength, lb./sq. in. ..	800
Elongation, %	150
Hardness Shore A	60
Compression Set, %	23
Tear Strength, lb./in.	70

TABLE 4
COMPARISON OF KEL-F ELASTOMER 5500 WITH COMMERCIAL ELASTOMERS

Tests	*Kel F 5500*	*Buna-N*	*Neoprene*	*Hypalon*	*Butyl*
Retention of original tensile strength after immersion in white fuming nitric acid for 2hr. at 72°F.	100%	Disintegrates in 30min.	Disintegrates in 1min.	20%	Disintegrates in 30min.
Retention of original tensile strength after exposure to 0.013% ozone for 6hr. at 72°F. Rubber stretched 30%	100%	—	—	100%	70%
Volume change after immersion in Type III fuel (70 : 30 Iso-octane Toluene) for 24hr. at 72°F.	4%	20%	60%	60%	200%
Volume change after immersion in fuming H_2SO_4 for 24 hr. at 72°F.	0.5%	Charred	Charred	Charred	—
Flame retardance	Excellent	Poor	Good	Fair	Poor

TABLE 5
PROPERTIES OF KEL-F 3700 AFTER AGEING AND IMMERSION

	Original	*Jet Fuel (JP5)*	*ASTM Reference Fuel B*
Time, hrs.	—	500	500
Temperature, °F.	RT	400	400
Tensile strength, psi ..	3,050	560	580
Elongation, %	330	460	300
Hardness Shore A	62	49	38
Volume swell, %	—	+25	+47

Other Fluorine Containing Elastomers

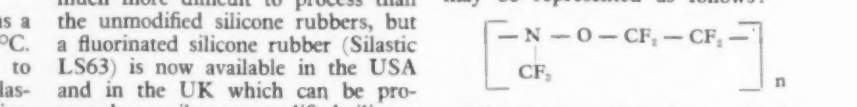
Fluoropolyesters[8]

A great deal of research and development work has been carried out in the USA over the past ten years on fluorine containing polymers. A programme was initiated under government sponsorship (American Air Force) to investigate condensation type elastomers. The object of this work was to develop an elastomer combining thermal stability, fuel resistance and flexibility down to −65°F. or even lower. One of the early elastomers developed was hexafluoropentyleneadipate and it was discovered that this material could be cross-linked to a tough elastomeric material.

Further development work was carried out and it was found that with the correct reinforcement by filler addition and cross-linking, useful elastomers with the above required physical properties could be obtained. Brittle points of −98°F. were obtained, but unfortunately crystallization at moderately low temperatures occurred and this seriously limited its usefulness. Many attempts were made to overcome this by the preparation of other polyesters, but these efforts were only partially successful. The introduction of Silastic LS63, which possesses high thermal stability, good fuel resistance with excellent low temperature characteristics ensured that the fluoropolyesters would be of academic rather than commercial interest, unless, of course, a startling development was made.

Trifluoronitrosomethane tetrafluoroethylene[7]

It has been reported that amongst the many additional products of trifluoronitrosomethane, CF_3, NO and tetrafluoroethylene $CF_2=CF_2$ is an interesting semi-organic polymeric substance which may find applications as an elastomer. Structurally it may be represented as follows:



The absence of hydrogen in the polymer chain is an unusual feature of this material, also it has the un-

Continued on page 550

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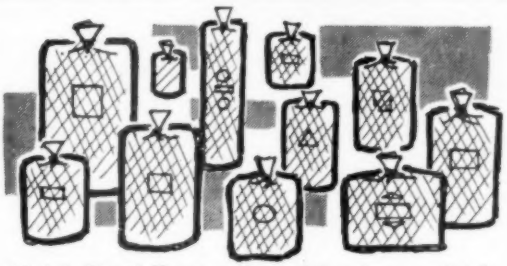

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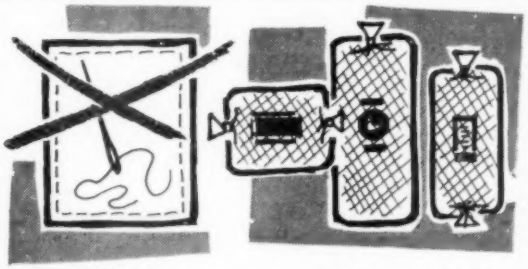

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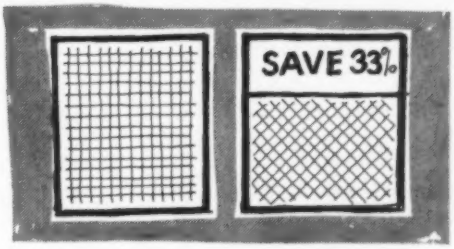

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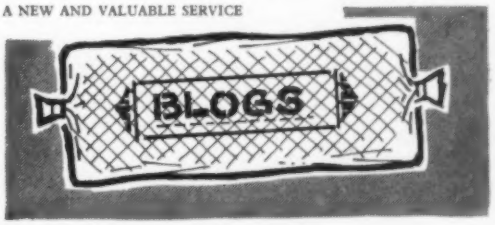

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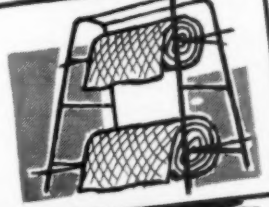

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PLASTICIZERS FOR PVC—PART 5

Commercial Plasticizers—2

POLYMERIC AND SPECIAL PURPOSE TYPES

By W. S. PENN, BSc

ARTICLE No. 4 described the commercial plasticizers of Groups 1, 2 and 3. The present article is concerned with the remaining commercial plasticizers of Groups 4 and 5.

The Group 4 plasticizers include the so-called polymeric types designed for high temperature work, to resist leaching and so on. Both of these aspects are considered in the present article.

An interesting development in the 'polymeric' field is that of the high molecular weight monomeric esters. They are not, of course, polymeric and are usually included in the group for convenience. Such materials are making considerable headway since they have the low viscosity of the monomeric types and yet the retentivity of the polymeric types. The development of their use should be followed with great care.

The Group 5 plasticizers are the miscellaneous types. Included in them, however, are the various epoxy compounds, certain extenders and specialised plasticizers. The reasons for the use of all of them are fully discussed.

Group 4 Plasticizers

The Hexaplas Plasticizers

These plasticizers, manufactured by I.C.I. Ltd. are either polymeric plasticizers or intended to act as such.

Hexaplas PPA was the original material in the group and is based on polypropylene adipate. This long chain molecule has very low volatility, high resistance to extraction by solvents and is virtually non-migratory.

These advantages are very real, but there are also some disadvantages. Because of its high molecular weight and viscosity it has inferior plasticizing and compounding properties. To partially overcome the difficulty it is necessary to use higher mixing temperatures and longer mixing times. The material is not satisfactory on its own in pastes and is likely to cause sticking on sheeting mills and calender bowls. A further disadvantage, among other less obvious ones, is the high cost.

One way of reducing the processing difficulties is to blend the Hexaplas PPA with monomeric plasticizers. This is effective, but, as would be expected, the advantages of the polymeric plasticizers are reduced in proportion to the amount of monomeric plasticizer present. Because of this, I.C.I. Ltd. developed Hexaplas PPL. This plasticizer, although not as efficient as the monomeric types, has much better plasticizing action than PPA. The improved processing properties are obtained at the expense of some loss in its volatility, migration and non-extraction properties. Nevertheless, these are substantially better than the monomeric plasticizers.

TABLE 1

COMPARISON OF HEXAPLAS PLASTICIZERS
(100 *polymer:* 50*phr plasticizer:* 2*phr stabilizer*)

	PPA	*PPL*	*LMV*	*DOP*	*TTP*
Modulus at 100% elongation ..	2,530	1,900	2,320	1,580	2,000
BS hardness	14	21	10	30	28
Weight loss at 100 C. (250hr.) % extraction:	1.8	2.2	1.8	28	11.8
Kerosene	+0.2	—6.1	—2.7	—24	—3.5
High octane aircraft fuel RDE/F.75 (10 days at 20 C.)	—2.9	—23	—20	—28	—28
Low temperature flex, C. ..	+4	—8	—1	—20	+2

The final I.C.I. Ltd. development was a material intermediate between the extremes of PPA and PPL, an attempt to achieve the best properties of the two materials. The result was Hexaplas LMV, a plasticizer well worth trying. A detailed comparison of all three plasticizers between themselves and with DOP and TTP is given in Table 1.

Paraplex Plasticizers

Although these plasticizers are not made in Britain they are so well known throughout the world that no description of commercial products would be complete without them. They are manufactured by the Rohm and Haas Co. but their composition is not disclosed, although they are high molecular weight types imparting the usual properties. A detailed list with some of their properties is given in Table 2. The main general differences between them are as follows:

Paraplex G-25

This has good compatibility and stability. It also has good resistance to extraction by petrol, oil, water, soap and detergents and resistance to migration or 'marring'. It is also used in high grade upholstery, electrical tapes and insulation, refrigerator gaskets, etc.

Paraplex G-40

This plasticizer still has the general properties of high molecular weight plasticisers but is comparatively low in cost. The low temperature properties are inferior to those of the other plasticizers but it has high resistance

TABLE 2

COMPARISON OF PARAPLEX PLASTICIZERS
(*Plasticizer % below to give modulus of* 1,550*psi*)

	G25	*G40*	*G50*	*G53*	*G60*	*G62*	*DOP*	*TTP*
% plasticizer	40.5	45.0	41.0	42.5	37.5	38.5	35.0	38.5
Tensile strength, psi	2,050	1,450	2,100	2,200	2,250	2,200	2,250	2,350
% elongation at break ..	345	170	380	365	375	375	350	310
Shore hardness (10sec.) ..	73	76	72	70	73	73	74	70
Brittle temp., C. ..	—14	+10	—13	—11	—20	—15	—26	—5
Extraction %:								
Oil ..	0.3	0.3	3.5	1.5	7.0	4.5	9.0	2.5
Petrol ..	0.2	0.0	3.5	1.8	10.5	8.5	19.0	11.0
Soapy water	0.4	4.6	6.8	2.4	0.3	1.5	2.5	8.1
Volatilization ..	0.5	1.2	1.3	0.7	0.3	0.3	8.1	3.4

to migration into rubber and rubber-like products. G.41, a development of G.40, retains its advantages, but has better compatibility at high plasticizer levels, better low temperature properties and resistance to extraction by soapy water.

Paraplex G.50

A general purpose polymeric plasticizer, inferior to many of the others for its 'polymeric' characteristics, but much superior to DOP which it resembles in its handling and processing characteristics. This is its special advantage.

Paraplex G.54

This is a superior plasticizer specially designed to give freedom from exudation on exposure to high humidity at elevated temperatures. It is also particularly good from the point of view of marring (polystyrene, lacquers and baked enamels) resilience, plasticizing action, resistance to copper corrosion, electrical properties and resistance to extraction. Consequently, it is suitable for use in high temperature electrical insulation (particularly in the tropics), film for babywear and hospital sheeting.

Paraplex G.60

An ester type plasticizer suitable for food packaging. It has good low temperature properties and gives good stability against heat and light which may save stabilizer costs. G.61 is better on long term exposure.

Paraplex G.62

A fairly general purpose plasticizer with good all round properties, approved for food packaging. It also allows fast calendering. In many ways G.62 and G.61 are process aids and a proportion can be incorporated advantageously in all compositions. They give heat and light durability and improve processing properties.

A series of plasticizers such as the above, grows over a period of time and there are likely to be constant developments. G.54, above, is similar to G.52, but is improved from a remarkable number of points of view. This example by Rohm and Haas shows the number of detailed characteristics which sometimes need to be examined. G.54 has the following advantages over G.53:—

(1) Retention of compatibility during high-humidity service.
(2) Retention of compatibility during exposure to sunlight behind glass, in formulations containing G.61 and G.62.
(3) Plasticising efficiency and processing properties, assisted by its lower melting point.
(4) Improved resiliency. This is important since polymeric plasticisers are usually regarded as giving 'dead' stocks.
(5) Low temperature flexibility.
(6) Soapy-water resistance.
(7) Electrical properties in clay filled formulations.

The Diolpates

This interesting range of polymeric plasticizers is manufactured by Briggs and Townsend Ltd. They are of varying viscosity (and therefore ease of incorporation) ranging from Diolpate PPA (1900cs) down to Diolpate THL (20-30 poises).

The higher the viscosity, the higher the mixing temperatures and with Diolpates PPP, 195 and 214, 10°C.-15°C. higher than with monomerics is recommended. The Diolpates are compatible up to 75phr without signs of tackiness or sweating-out. All of the series have excellent resistance to extraction by a wide variety of chemicals and have very low volatility. This means they are valuable in high temperature stocks.

Bisoflex PCB

This plasticiser, manufactured by Distillers Co. Ltd. was specially designed for cable insulation which must withstand extended heat ageing. Continuous operating temperatures of about 113°C. are claimed.

As might be expected, the low temperature properties are not good but volatility is very low, which accounts for the good heat ageing. Some comparative ageing data are given in Table 3. The great superiority over TTP is most marked.

The Reoplex Plasticizers

This series, manufactured by the Geigy Co. Ltd. includes a useful range of polymeric plasticizers, of varying viscosity. They all have the usual properties of producing good heat ageing compounds and relatively poor low temperature properties. However, all have good resistance to extraction and migration.

Reoplex 641 was designed as a high temperature cable plasticizer. The elongation of compounds containing it remains virtually unchanged during the 60 days' test at 113°C. Its viscosity is comparatively low which facilitates ease of incorporation. This feature is taken a stage further in Reoplex 531, which is quite easy to incorporate at some slight loss of ageing properties but improvement in low-temperature characteristics.

Hercoflex 707

This plasticizer, made by Hercules Powder Co., is a high-molecular weight monomeric ester used as a 'polymeric'. Although it has a lower molecular weight it has the usual properties of the polymerics. It is a derivative of pentaerythritol.

Apart from the usual properties expected of such a plasticizer, its low viscosity makes it valuable for dry blending and plastisols. It is also acquiring some reputation as a plasticizer for high temperature cable compounds.

Group 5A Plasticizers

The plasticizers in this group are the epoxidized type, which are now manufactured by several companies from varying materials as described.

Abrac 'A'

This is an epoxidized oil manufactured by A. Boake Roberts and Co. Ltd., and is an efficient plasticizer as well as stabilizer. Although Abrac 'A' has relatively high molecular weight, it is not polymeric. Consequently, it has relatively low viscosity and is readily incorporated in pvc compounds at normal processing temperatures.

In spite of these differences from conventional high molecular weight plasticizers, it has the valuable characteristics of low marring, good low temperature properties and low extractability. Stability is of course good, volatility is low and electrical properties are comparable with DOP. These properties are summarized in Table 4.

The outstanding resistance to volatility is very noticeable. The low temperature properties are also clear.

Lankroflex ED.3

This is an epoxidized monoester manufactured by Lankro Chemicals Ltd. (Abrac 'C' is also an epoxidized

TABLE 3

AGEING PROPERTIES OF BISOFLEX PCB

	UNAGED		AGED AT 113°C.			
			4 WEEKS		6 WEEKS	
	Tensile Strength psi	*Elongation at Break %*	*Tensile Strength psi*	*Elongation at Break %*	*Tensile Strength psi*	*Elongation at Break %*
Bisoflex PCB ..	3,280	240	3,000	240	2,850	207
TTP	4,360	175	6,070	Less than 20	8,225	Less than 20

TABLE 4

PROPERTIES OF ABRAC 'A' COMPOUNDS
(*Geon* 101 100: 60*phr plasticizer*: 2*phr lead stearate*)

	Abrac A	*PPS*	*DOP*	*TXP*
Tensile strength, psi	2,950	3,030	2,550	3,400
Modulus at 100% elongation	1,500	2,120	1,150	2,050
Elongation at break, %	335	270	355	280
Cold flex, °C.	—15.5	—7.0	—22.5	+1.5
% weight loss (65hr. at 120°C.)	0.43	1.13	8.62	2.99

monoester manufactured by A. Boake, Roberts and Co. Ltd.). It is an economical low-temperature plasticizer and stabilizer for pvc, although it has low solvent power at room temperature and cannot be used as the sole plasticizer. However, this makes it very useful for plastisols.

Lankroflex ED.3 has low volatility and therefore good ageing properties. The low-temperature properties are as good as DOS and resistance to extraction by soapy water is high.

In compounding, this plasticizer should not constitute more than 35% of the total plasticizer content, and it should not be used with unsaturated plasticizers or stabilizers of which the oleates and ricinoleates are examples. This is because side reactions with the epoxy groups take place, leading to the formation of non-compatible products which cause tack. On the other hand, when used with other plasticizers, particularly phosphates and phthalates, it improves their heat and light stability.

TABLE 5

PROPERTIES OF LANKROFLEX ED.3 COMPOUNDS

Polymer	100	100	100	100	100
DOP	50	—	—	35	35
DOS	—	50	—	—	15
ED.3	—	—	50	15	—
Stabilizer	3	3	3	3	3
Tensile strength, psi	2,450	2,090	2,370	2,350	2,350
Modulus at 100%	1,460	1,100	1,480	1,470	1,230
Low temperature flexibility, °C.	—22	—47	—47	—28	—28.5
Tensile strength, psi (after 4 weeks at 100°C.)	2,740	—	—	2,760	2,740
Elongation, % original	290	—	—	315	315
Elongation, % after ageing	205	—	—	290	285

Some typical properties of Lankroflex ED.3 are given in Table 5.

The very good low temperature properties of ED.3 may be readily seen from this table. The ageing properties are also good.

Crestapol 932

This plasticizer is made by Scott Bader and Co. Ltd. It is a pale yellow epoxy compound which has the usual stabilizing as well as plasticizing action. In pvc it must be used in conjunction with a primary plasticizer.

Celanese ESBO

This material is an epoxidized soya bean oil and as such is a stabilizer and non-migratory plasticizer for pvc. Among other properties it has the advantages of being non-toxic, resistant to marring and to extraction by soapy water, oils, etc.; it is stable to heat and light and causes no skin irritation in such products as baby-wear.

Group 5B Plasticizers

These plasticizers are the extenders and are not to be used alone. They consist of a variety of materials of which some examples are given.

Chlorinated Compounds

One of the most common and useful secondary plasticizers is Cereclor 42, a chlorinated paraffin manufactured by I.C.I. Ltd. It is non-inflammable, odourless, non-toxic and of low volatility.

It is not a true plasticizer but can be used to replace quite high proportions of most of the common plasticizers with which it mixes freely. Its use results in a worthwhile saving in cost. Usually about one-third of the plasticizer will be replaced with Cereclor 42.

In spite of its chlorine content it is quite stable, as evidenced by its extensive use in cable compounds. Its compounds are a little harder than with all conventional plasticizers, but an increase in total quantity of plasticizer offsets this.

The Chlorinated Paraffins P.30 and P.50 are more recent developments of I.C.I. Ltd. They are similar to Cereclor 42 but are less viscous, more volatile and not as stable. Sweating is more likely to occur, particularly with P.30, and electrical properties are reduced slightly. Special stabilizer systems are required and the materials are not suitable for use at high temperatures. Some results are summarized in Table 6.

Perhaps the most obvious difference is the increase in hardness when replacing some of the 60 parts DAP with the extenders. However, the remarkable comparison between 50 parts DAP with 60 parts combined plasticizer is outstanding. The chlorinated paraffins, particularly P.30, are noticeably inferior in some respects to Cereclor 42, a point which should be closely watched.

Another product is Reomol DV.50 (The Geigy Co. Ltd.) a chlorinated aliphatic hydrocarbon. It is used in much the same way as the products already described.

Petroleum Products

Dutrex 3 (and others in the series) is a petroleum residue manufactured by the Shell Chemical Co. Ltd. It is an extender only used to the extent of 5-10phr. Used in these proportions it hardly affects properties at all and, in fact, can slightly improve electricals.

Bearflex 1751 is a liquid hydrocarbon resin made by the Golden Bear Oil Co. (Croxton and Garry Ltd.). It is a secondary plasticizer with an equivalence factor (compared with DOP) of 1.7. Up to 70% of primary plasticizer can be replaced with it.

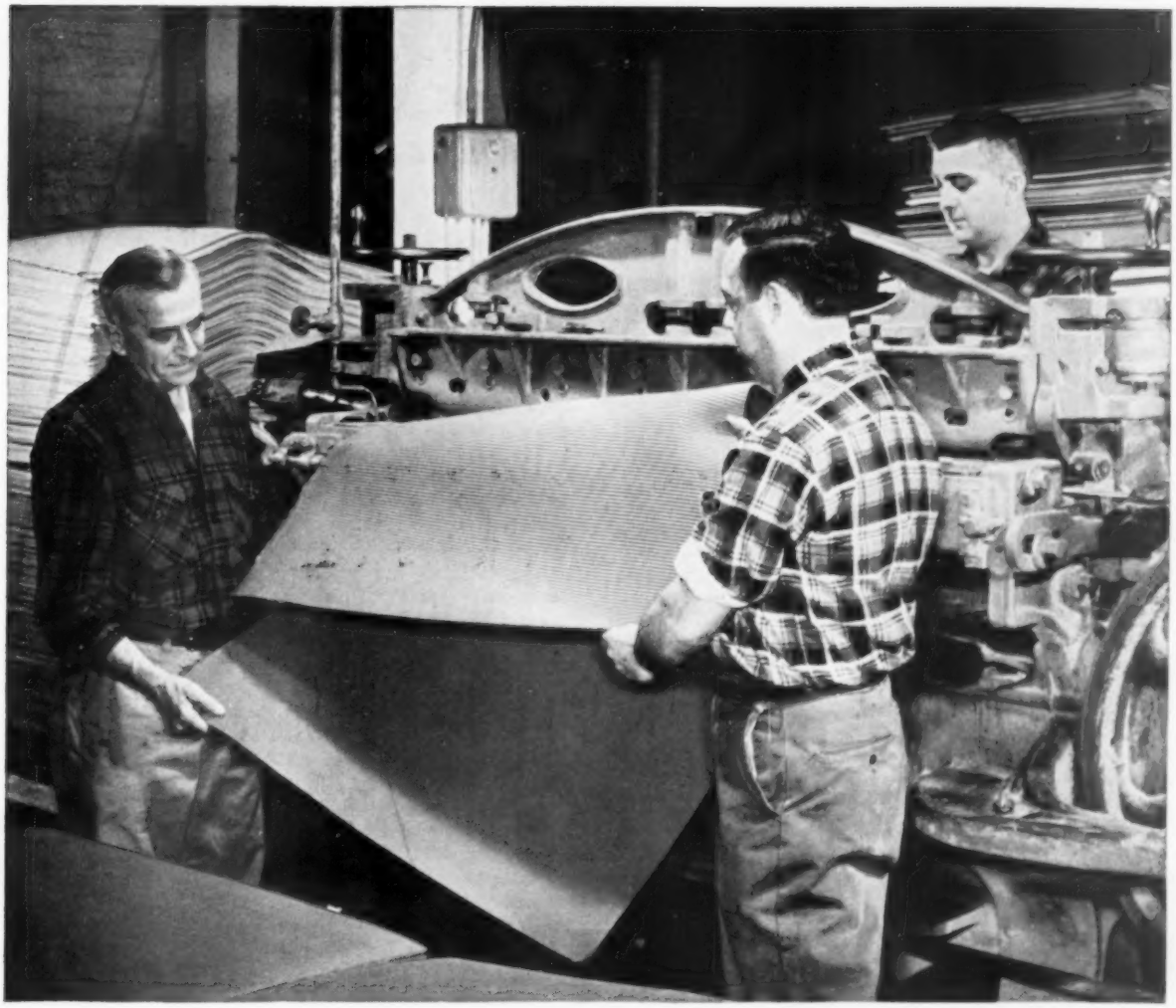
It is low in cost as well as sg, and with the amount of it that can be used it will result in really low cost compounds. As a non-polar compound it improves the electrical properties of pvc compounds. Even polymeric plasticizers can be partially

Continued on page 550

TABLE 6

PROPERTIES OF CHLORINATED PLASTICIZER EXTENDERS
(100 *Corvic* D.65/8: 8*phr white lead paste*: 1*phr calcium stearate and plasticizers given below*)

DAP	60	50	40	40	40
Cereclor 42	—	—	20	—	—
P.30	—	—	—	20	—
P.50	—	—	—	—	20
BS softness at 23°C.	54	40	40	45	46
Tensile strength, psi	2,360	2,880	2,720	2,380	2,760
Modulus at 100%	960	1,290	1,270	1,090	1,260
Elongation at break	360	340	390	350	380
Cold bend, °C.	—55	—45	—45	<—60	—45
Volume resistivity, ohm. cm.	1.3×10^{13}	3.5×10^{13}	5.4×10^{13}	8.0×10^{11}	6.0×10^{12}
Ageing loss, % (24 hr. at 100°C.)	0.58	0.5	0.49	2.7	0.9



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VIEWS and REVIEWS

Teaching Technology

WE all acknowledge, I think, that in the hands of the teachers of today lies the well-being of our industry tomorrow. An increasingly technological civilization demands — and is receiving — an increasingly technological education.

But technical knowledge is not everything. Initiative, creativity, independence of mind, and an humane culture are all required too.

To produce these in the unwilling child and in the only-partly-consenting adolescent is a major problem of our time. It would be surprising if you expected a teacher of science and technology to have notions on the pedagogical theory of all this, yet you will find many germane ideas in a paper by Professor W. M. Thring of the Dept. of Fuel Technology and Chemical Engineering, University of Sheffield, entitled 'The Role of the Universities in Teaching Technology', appearing in *The Advancement of Science*, Vol. 17, No. 69, pp. 456-460.

Educational Snobs

Students of technology must have a good grounding in both pure and applied science, and in their practical applications. Fundamental pure science and fundamental applied science differ only in their aims, not in the quality of thought used.

'Pure science has to overcome the tendency to regard itself as superior to engineering and applied science. . . . The only valid snobbishness in education is that which relates to the quality of thought'.

Something like 80 or 90% of the students who come to the university to the faculty of Pure Science finish up in industry as applied scientists.

The Motive Power — Enthusiasm

'At present the main reason why a boy chooses a subject at a university is either because it is a subject he has already learned at school, or because a master at school has encouraged him in this subject.

'Whether an undergraduate does well in his exams. or not depends more on whether the subject has been taught in a way which has aroused his interest and enthusiasm than it does on his inherent level of intelligence. . . . This is the dynamic view of university teaching. The top 1% will get a good university degree if we do not teach them at all, but merely refer them to some text books, but the problem is how can we present the material in such a way that it will excite and interest the next 5% who are potentially honours degree men, but who have not been kindled by the teaching at school, or by their parents, or by their contacts with practical problems'.

Perhaps you detect in that a tendency to overstate the case, but you will agree that dynamic teaching will get further than the take-it-or-leave-it kind. The difficulty is, as so often, not in the theory but in putting it into practice.

Self-propelled Graduates

Professor Thring sees the difficulties well enough. You cannot run on one leg, he says. Just as a manufacturing concern must do research in order to continue to manufacture, so the teaching of technology must be supplemented and vitalized with active research. In this way, the teaching is constantly fed back with new ideas and principles while the research is nourished with problems arising from the teaching.

Then he makes his most trenchant and telling remark: '. . . the graduates will be much more valuable to industry if they have learned to be self-propelling in research after the completion of their undergraduate course. . . . We attempt, in training a man for a PhD, to bring him to the point where his director in industry will be able to say to him "Go away and solve this problem and come back to me with the answer".'

The Humanities with Science

The educator has a further problem — how to get a quart into a pint pot. A good technologist must nowadays be taught so many pure and applied sciences that his teacher is hard put to it to find a moment and a means of introducing the humanities. 'When professors of technological subjects are tackled on this question they always retort that the average university-trained technologist knows more about all the arts subjects than the average arts man knows about technology, and this argument can certainly be supported'.

Voluntary lectures in the lunch hour and in the evening go a little of the way but 'the finest method of all is the method which has grown up spontaneously at the older universities of small groups of undergraduates collecting in each other's rooms for arguments over coffee in the evening'.

'The more or less compulsory dining together of all the students of one year in one college is obviously also a very desirable feature as this forces them to meet their contemporaries out of the comparatively small group and it is thus an easy matter to go off and have a good argument after a meal'.

Extruders

It is difficult for the non-expert to assess how new is the information given in the four papers read at last year's Extrusion Symposium of the London and District Section of the Plastics Institute and now published in the August 1961 issue of the Transactions of the PI.

For instance, the paper read by my friend, Herr W. F. Gauhe, appears on the face of it to be a review of existing knowledge, while that of D. Grant seems to be based on original work, though the opening sentence of B. H. Maddock's paper may suggest otherwise. They are all concerned with the basic features of extruders and however 'new' the information they contain, they are all right-up-to-date.

An Old Servant Taught New Tricks

The symposium, judged by these published papers, seems likely to have been very useful for the specialist and the general technologist will probably do little more than glance at them. This is a pity because they are worth attention.

The extruder is one of the oldest and most versatile machines in the rubber and plastics industry; it must be

COMMENT ON SCIENTIFIC AND INDUSTRIAL MATTERS

by **F. C. JENNINGS**

quite as old as the calender and nearly as old as the roll mixing mill.

With a machine so old and well-studied, it might seem strange that further development is still possible. These papers show that it is and will be. Perhaps we are asking more of it nowadays.

For instance, Clegg and Huck discuss 'The effects of extrusion variables on the fundamental properties of tubular polythene film,' a subject which is obviously quite new, and they conclude: 'There is undoubtedly still great scope for further research'. Gauhe discusses the comparatively recent development of wide-bar extrusion of unplasticized pvc sheet.

Valves and Vents

The paper by D. Grant of Bone Brothers (pp. 130-6) deals with throttle valves and vents in extruders, which, because one development must always wait upon others, were preceded by improvements in drive units and better instrumentation. Together they give lower conversion costs, better control of the operation of extruding, and of the quality of its products.

Throttle valves in extruders are of several kinds but they all serve a similar purpose, supplementing the work of the screw which is 'not only to pump the plastics through the die but also to ensure that the melt reaching the die is homogeneous and at the correct temperature and viscosity . . . increased mechanical working on the screw gives improved homogeneity and product quality. A throttle valve at the end of the screw makes it possible to regulate the pressure build-up and the degree of mechanical working on the screw and hence the product quality'.

The author's work on extruder-dispersing of carbon black in polythene proves this contention.

The throttle valve is useful also in the extrusion of thin films, tubes, and monofilaments because it makes closer control of viscosity and higher temperature.

Devolatilization

Mr Grant describes several forms of throttle valves and then discusses the venting of extruder barrels, which permits the 'devolatilization' of the melted plastics, *i.e.*, the escape of substances (water is one) which are present in the plastics material and are volatile at the temperature of the melt.

Venting is achieved by dividing the screw into two parts by a section which has a much deeper cut thread and over which the barrel-vent is placed. Because the thread is cut deeper in the middle section, the melt does not fill it providing the output of the second part of the screw is not less than that of the first part. Usually this output is controlled by a throttle valve.

Extruding Sheet

Herr Gauhe's paper, 'Sheet extrusion of unplasticized polyvinyl chloride', very thoroughly surveys this specialized field and particularly the contributions made by his own firm, Reifenhäuser KG.

The extrusion of unplasticized pvc is difficult because of the high viscosity of the melt and the narrow temperature range available before decomposition of the pvc sets in. But as the raw material is cheap and has excellent physical properties, it is desirable to develop a continuous sheet-making process instead of the expensive, older, discontinuous, laminating or moulding processes.

Among the basic requirements of the wide-band extruder (for unplasticized pvc sheet of thicknesses between 1 and 9mm. and widths up to 60in.) are, of course, adequate motor output, a ratio of length/diameter for the screw of between 20 and 25:1, and several, separately adjustable, heating and cooling zones. Acid-resistant cylinder-linings are not required.

Screw threads must not be too deep, and, with the larger diameter screws, a special tip is needed to eliminate too long a dwell-time in stagnant spots.

Although, basically, the design of extrusion head is similar to those used for low-viscosity polymers, special attention has to be paid to some points, especially the flow channels in the head, because of the high viscosity of unplasticized pvc.

Haul-off and polishing machine speeds are somewhat more critical.

Herr Gauhe ends an informative, painstaking paper with the warning: '. . . not all pvc blends are suitable for sheet manufacture . . . with every unknown pvc blend it is necessary to carry out trials. . . .'

The other two papers appear in abstract only. One, by B. H. Maddock of Union Carbide, USA, concerns the pressures developed within the barrel along the screw; the other, by Dr P. L. Clegg and Dr N. D. Huck of I.C.I., propounds a relationship between the mechanical and optical properties of extruded tubular polythene film and the melt history of the polymer from just before the die to just after the freeze line. I would have liked to read this paper *in extenso*.

Scientists in Management

The Transactions of the PI for August 1961 also carries a paper on pp. 124-130 on protective packaging by D. Gonda of E.P.S. Ltd. Even though the author here limits himself to protective packing in its engineering aspects, I suspect he found the limitations imposed by a single paper rather restricting. He might be given more room to do justice — as I am sure he can — to such a wide, important, and interesting subject by being asked to write a PI monograph.

Now, however, I would like to make a comment on his introductory remarks where he traces the development of industry from the craftsman, the one-man business, to the eighteenth century when the accountant became the dominant figure, to the Industrial Revolution, 'which resulted in over-production, and selling became a new problem. So, in the post-War-World-I period, the salesman became the key man; today some companies are still controlled by the salesmen, who are the top executives'.

Mr Gonda then says that 'the post-World-War-II period . . . has witnessed the rise of the engineer and scientist to senior management'. If by that he means what I do, I think he would find great difficulty in sustaining the thesis that even the scientifically educated, in Britain, at any rate, have more than a fractional representation in the policy-making management of industry.

CHARLES JENNINGS

MEN and MATTERS

A Review of People and Events

by Peter Richards

WHILE employees of the Glasgow rubber manufacturing firm of George MacLellan and Co. Ltd. were giving blood to the local blood bank, supplies in special containers were being rushed to a Glasgow hospital so that a life-saving 'hole-in-the-heart' operation could be performed on a five-year-old boy.

The company was told that the boy 'came through the operation very well indeed', and that without the multiple transfusions of fresh blood from the MacLellan volunteers the operation simply could not have taken place. Miss Dorothy Nelson, organizing secretary of the Glasgow and West of Scotland Blood Transfusion Service, said: 'I hope that all at George MacLellan's will feel rewarded in the knowledge that they have been of such great service to this child'.

The company's employees have a quite exceptional record for donations to the Glasgow Blood Bank. The 200 MacLellan voluntary donors represent one-third of the total labour force — compared with an average of less than 10% for factory blood transfusion sessions in Glasgow and the West of Scotland generally.

Democratic Conference

One of the problems facing a world-wide organization is that of communication. The Western Bata Organization tackled it last week by holding a sales and production conference at its Mohlin, Switzerland, factory.

It was certainly an impressive affair. Top executives flew in from many countries. Commercial seminars were held where results of market research were debated by salesmen, producers and designers, leading to the creation of new ideas in footwear in leather, rubber and plastics. Technical discussions showed the ever-increasing part played by chemistry and the physical sciences in shoemaking.

Not only was a special building erected for the project, but the company did something that ought to be followed by other firms. It flew out parties of employees to see the conference in action. For instance, from the UK a chartered Viscount took 60 representatives from the East Tilbury and Maryport factories, including engineers and designers, students and graduates from the Bata Technical College, and senior operatives and foremen from all parts of the factory. Not only does this sort of democratic conference bring the employees closer to the organization — it also shows them that the executive abroad does not spend his time living it up at night spots on his expense account.

Board Changes at BIP

British Industrial Plastics has announced the following appointments of chairmen of its manufacturing subsidiaries: BIP Chemicals Ltd.: Dr W. Blakey; BIP Reinforced Products Ltd., Streetly Manufacturing Co. Ltd., and Hornflowa Ltd.: J. E. Beard; BIP Engineering Ltd. and BIP Tools Ltd.: F. E. Mills.

These changes follow the recent appointment of R. M. Bateman as chairman of British Industrial Plastics. Mr Bateman, who is deputy chairman of Turner and Newall Ltd., was appointed to the BIP board last May and succeeded the late C. H. Glassey as chairman in August. At the same time, Dr W. Blakey, joint-managing director of British Industrial Plastics, was appointed deputy chairman of the company.

All three men are long serving members of the group: Dr Blakey and Mr Mills joined it 33 years ago, and Mr Beard 23 years ago.

The British Bata Group from East Tilbury and Maryport before flying to the Western Bata Conference in Switzerland. *(See: Democratic Conference)*

David Lewis

North British has appointed David C. H. B. Lewis its technical sales representative for South Wales and the West of England for its industrial products division. Mr Lewis, who has extensive industrial rubber experience, was at one time with BTR Industries.

He is very well known in Welsh golfing circles. Boy champion of Wales in 1934, he won the Welsh Amateur Championship in 1937, capped for Wales on 14 occasions, and was a Walker Cup trialist in 1938.

During war service in Burma he lost a leg, but despite this handicap he plays off two at Royal Porthcawl. He is an active administrator in golf as executive of the Glamorgan and Welsh Golf Unions.

Retirements at John Bright

T. V. Young has been appointed general manager of the canvas department of John Bright and Bros. Ltd. He succeeds H. Stott, who retired recently after over 50 years' service with the company.

J. Woods, doubling engineer, and W. E. Ward, salesman, have also retired. At a farewell party retirement gifts were presented from the management and staff.

A Million Rubber Springs

The one millionth rubber spring, produced exclusively for BMC's Austin Seven and Morris Mini-Minor cars, has been presented to its designer, Alex Moulton, by G. D. Beharrell, general manager of the Dunlop Rim and Wheel Co.

This high figure of production is particularly notable as the rubber units are manufactured to within very

ISOPRENE RUBBER—now commercially available from the U.S.A.

'CARIFLEX' I-305—a *cis*-1,4-polyisoprene recently developed from 'Cariflex' 1-300. The improved characteristics of this new polymer are lighter colour, greater clarity, lower accelerator requirements, (the same now as natural rubber) greater resilience—plus better ageing and colour stability.
'CARIFLEX' I-500—especially suitable for lower cost, light coloured products. It is an Isoprene Rubber type extended with 25 phr of a light-coloured, non-staining oil and offers similar physical properties to 1-305. Both these new products can be blended with most other rubbers—including natural, SBR, NBR and CR—and can of course be processed on conventional equipment.

For further details of these and other rubbers in the 'Cariflex' range consult your Shell Company (in the U.K., apply to Shell Chemical Co. Ltd., Plastics & Rubbers Division, 170 Piccadilly, London, W.1.)

Shell Chemicals

SHELL

accurate limits at this specially-equipped Dunlop factory.

Now in service on 250,000 of these BMC 'twins', the advanced rubber suspension units and flexible drive couplings give good ride and handling characteristics in all conditions.

British Recovered Rubber

British Recovered Rubber and Chemical Co. Ltd. has announced that Frank M. Read and Denis Tye have joined the board of directors.

Garth C. Swann has been appointed assistant managing director, and Alan Crook, director of the company, has been appointed general manager.

Cocktails With Victor

The new Vauxhall Victor splashed into the public eye with a welter of press advertisements, lighted cars in showrooms and 'invitations to have cocktails with Victor at your local garage'.

One departure I noticed from the standard Vauxhall pattern was the bucket seats as standard fittings in the De Luxe and as optional extras in the Super and Estate car versions. These seats are sprung with Pirelli webbing, the resilience of which soaked up any of the road-shocks when I went out for my trial spin.

Microcell Directors

F. T. Jones has been appointed a director, and J. A. Grace commercial director, of Microcell Ltd., a subsidiary of BTR Industries Ltd. As production manager with Hunting Aircraft Ltd., 46-year-old Mr Jones was responsible for the production of Pembroke, piston-engined and jet Provosts, together with the manufacture of experimental research aircraft.

Until accepting his new position with Microcell Mr Grace, who is 49, was manager of the sales and commercial division of the De Havilland Aircraft Co. Ltd.

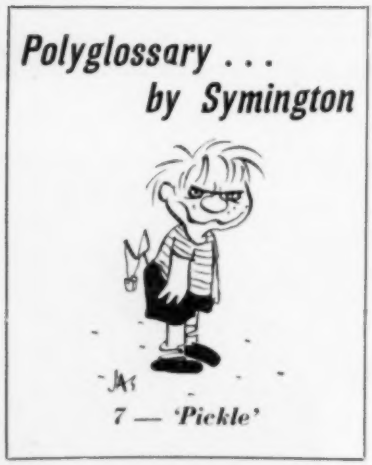
Appointments in Brief

P. J. March, director of Shell Chemical Co. Ltd., and general manager, industrial chemicals division, has been appointed to the board of directors of Styrene Co-Polymers Ltd. in succession to N. A. Iliff, managing director of Shell Chemical, who has resigned.

* * *

J. A. Roberts has been appointed technical sales manager of Plytawn Ltd., the newly formed subsidiary of Irish Ropes Ltd. He will operate in the UK and on the Continent from a London office.

Next fad in USA, and eventually here? B. F. Goodrich is making large, coloured rubber bands for college books — but at some colleges, after the fashion of the '20s, some girls are using them as head and waist bands



THE LEGAL ANGLE

Payment While Ill

By a Barrister

HAVE you ever wondered what *your* position would be if *you* were to fall ill? Could you be forced to 'resign'? Would you be entitled to your pay while you lay on your sickbed?

Or, putting it the other way round, must you pay your employees when they are off sick? Or, how long must they be ill before the law will allow you to consider their contracts of service at an end?

As usual, the first place to look is in the contract of service itself. If the man was engaged on the basis that he would be paid while ill — that is the end of it. Equally, if the contract of service provided that pay was dependent upon arrival at work — then clearly there was an agreement that no pay was to be expected while ill.

'But what of the majority of cases, where nothing is said about illness at all in the contract of employment?'

In a recent case it was decided — for the first time by the High Court — that, in the absence of a term implied to the contrary, a servant is normally entitled to be paid while ill. In other words, if the contract was silent on the question of payment during illness, then — unless the Court would be willing to imply a term into it that the servant was not to be paid — he would be entitled to his money.

'When, then, will such a term be implied?'

A Court will only imply terms into contracts when it is necessary in order to give them business efficacy. If the facts are such that — looking at all the circumstances — the reason why the parties to the contract had not made express provision for illness must have been that it was 'too obvious to need expressing', then it will imply a term. Otherwise it will not.

There was a case not long ago, for instance, where an employee in a chemical firm was off work for many brief periods through illness, and neither asked for nor was paid any wages while unable actually to work. When he fell seriously ill and claimed his pay, the Court said: 'No — from the course of conduct between the parties, we must imply a term that salary was not to be paid during illness'.

'If there is no term — express or implied — that a man is not entitled to pay while ill, how long must the company go on paying him if he is off work — indefinitely?'

He is entitled to his pay so long as he remains an employee. He remains an employee until his contract of service is duly terminated — which will be when he is given proper notice or wages in lieu.

To sum up. Unless there is something express or implied to prevent a man getting paid during illness — he is entitled to his money. And, what is more, he can go on getting it until the contract of service is put to an end, in the usual way.

Announcing 'Butakon' A 3052 I.C.I. new medium Nitrile rubber

light in colour – easy to process

The complete range of 'Butakon' A nitrile rubbers is now available in paper sacks, with polythene welded inner layer.

If you are interested in this new addition to the highly successful 'Butakon' A range of nitrile rubbers, and you have not yet received a sample, apply to your nearest I.C.I. Sales Office.

'Butakon'

'Butakon' is the registered trade mark for the butadiene copolymers manufactured by I.C.I.

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PB70

FLUORINATED ELASTOMERS Continued from page 538

usual skeleton of N—O—C—C—. It has been reported in literature that elastomers with molecular weights in excess of 1,000,000 have been produced exhibiting good chemical low temperature resistance and excellent non-flammability characteristics.

TABLE 8
PROPERTIES OF FLUORINATED SILICONE AFTER AGEING AND IMMERSION

Oil or Fuel	*Immersion Time and Temperature*	*Hardness Change Shore A*	*Volume Change %*	*Tensile Strength Change %*
ASTM No. 1 oil	70hr. at 150°C.	— 1	+ 1	— 3
ASTM No. 3 oil	70hr. at 150°C.	— 2	+ 5	—30
ASTM reference fuel B ..	70hr. at 20°C.	—12	+21	—45
Jet fuel JP-4	70hr. at 20°C.	— 6	+10	—25
MIL-H-5606 (Univis J-43) ..	70hr. at 135°C.	— 3	+ 9	—20
Skydrol 500	70hr. at 120°C.	—39	+25	—85
MIL-L-9808 (Turbo Oil No. 15)	70hr. at 187°C.	—12	+ 9	—40

Conclusion

The problem of improving fuel and solvent resistance without the loss of thermal stability in elastomers, has only been partially solved. It is a continual requirement of the specialized industries for elastomers with outstanding thermal stability combined with fuel resistance. The loss of physical strength at elevated temperatures has become one of the toughest assignments to the polymer technologist.

These specialized materials are high price — high performance materials. The prices range from £2-£8 per lb. in the UK and their present prices will not allow their consumption to be as high as is the case with neoprene, butyl rubber, etc. The specialized market is, of course, growing, but its growth rate is small, although it must be realized that if the price of the fluorine elastomers is reduced extensively, then they will certainly have a fair share of the ordinary market. It is the belief that the manufacturers are not concerned primarily with the price, but with providing the specialized industries with elastomers exhibiting the necessary properties they require.

These requirements are becoming more and more demanding as the need for further exploration into space continues. This is a challenge to the polymer technologist which he will, no doubt, gladly meet and defeat.

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PLASTICIZERS FOR PVC — Part 5 Continued from page 542

replaced with Bearflex 1751 without affecting their non-migratory character. The material also improves processing properties and substantially improves flexing characteristics.

Synthetics LI

This low-cost secondary plasticizer is made by the Hercules Powder Co. It is a pale monomeric fatty acid ester which imparts good low temperature flexibility and light stability. It is particularly useful in plastisols.

It should not be used in quantities exceeding 25% of the total plasticizer when approximately 50phr total is used. Even at these levels, however, it will improve the low temperature properties of DOP.

Group 5E Plasticizers

The description of commercial plasticizers would not be complete without some reference to the interesting products manufactured by Howards of Ilford Ltd. The company manufactures a special range suitable for vinyl films and coatings, including copolymers. Howflex BB, for example, is a mixture of the isomeric di-(dimethyl-cyclohexyl)oxalates. It confers good flexibility, adhesion and light fastness to coatings, the latter being particularly important. In this respect it is better than DBP and DOP. Howflex CC (cyclohexanol citrate) is used for similar purposes and is particularly useful in heat-sealing applications where a sharp melting point is required.

Plasticizers of this type are clearly very specialized, and application should be made to the manufacturers for full details.

Monsanto in Geneva

IN a move to strengthen its long-term sales, technical and investment position in Western Europe, Monsanto Chemical Co., of St. Louis, Missouri, USA, has announced the establishment of a European headquarters in Geneva by the company's wholly-owned subsidiary, Monsanto Overseas SA (MOSA).

Consolidation

The move consolidates a number of company operations that have been in existence at several locations in Europe. According to vice-president Marshall E. Young, chairman of the board of MOSA and general manager of Monsanto Chemical Co.'s overseas division, the outstanding success of Monsanto's research activity in Switzerland through Monsanto Research SA, of Zurich, and Geneva's central location in Western Europe are the key factors behind this consolidation. Monsanto Research SA, established in 1956 at Zurich, is a wholly-owned subsidiary of MOSA.

Sales Co-ordination

William M. Russell, president of MOSA, will be in charge of the Geneva operations. Also located at the Geneva headquarters will be William R. Haas, regional director of sales, now stationed in Paris, who will be responsible for MOSA's sales co-ordination throughout Europe; Dr. Charles H. Davenport, European technical representative at Geneva; and Donald B. Hirsch, manager of economic planning for Europe, who will joint the organization in Geneva later.

Mr Russell, who was born in Glasgow, has been European director of MOSA since March 1960, and has served with Monsanto since 1937. He joined the company in a sales capacity with the organic chemicals division, and was appointed director of sales for that division in 1953. He was appointed assistant general manager of the overseas division in 1958.

Laporte Safety Pack

Laporte Chemicals Ltd. has introduced a new five-gallon safety pack for its liquid organic peroxides. It was first demonstrated at Interplas.

The pack, 10in. x 10in. x 17in. high, is of light mild steel with an inner container of special grade polythene.

It has been approved by the Ministry of Transport as part of a new schedule of export packages for all organic peroxides.

Plantation Newsletter

DEALING WITH THE SMALLHOLDERS' 'HARD CORE'

by our Malayan Correspondent

FROM KUALA LUMPUR

MALAYA has 450,000 smallholders, the vast majority of them growing rubber. They produce about 60% of this country's natural rubber which last year totalled 715,000 tons. Their co-operation is imperative in any scheme affecting the future of the industry generally.

Unfortunately, however, there are still some — described as a hard-core — who to this day have made no effort whatsoever to replant with high-yielding trees, despite continual pleas since the Government's replanting scheme was launched in 1955. No amount of propaganda or publicity has been able to budge them, they cling to their old low-yielding trees and stubbornly refuse to fell them for replanting.

But this hold-out policy is likely to be broken if J. Fairweather, the chief replanting officer, gets his way. He has recommended that complsory replanting, carried out mechanically under supervision, may be the answer. He has also made it clear that, in their own interest, ways and means must be found of dealing with such smallholders.

Over the last two years, the increase in large group replantings or new plantings has been made possible by the increase in agricultural contractors who have acquired machinery of various types to carry out tree felling, ploughing, harrowing and terracing of rubber lands, and who are prepared to carry out work at competitive prices.

It is now possible to have old rubber lands cleared and prepared ready for planting within the range of $160 (under £20) to $240 per acre.

If planting and budding are required to be done and cover crops established this can now be arranged for at reasonable prices. In fact, there is evidence that in this mechanical age, many smallholders are prepared to pay for such work and thus save themselves the back-breaking job with an axe and a spade.

This would appear to be the answer in dealing with the laggards who just cannot be bothered to replant.

Another problem which has come to light, and one which seems to have escaped the attention of smallholders, is the matter of properly thinning out their trees over the first few years after being replanted. Many smallholders just cannot be convinced that it is in their interest to thin out and reduce the stand to the number per acre recommended for different ages.

To their way of thinking, the more trees there are per acre the greater must be the amount of latex.

Another Weakness

Mr Fairweather has also spotlighted another weakness. This has long been appreciated by everyone connected with the implementing of the replanting scheme and it is that the smallholder receives his fifth, or final, payment 3½ years after his holding has been replanted.

Normally his trees in a replanted holding will not reach tappable size for another two to two and a half years, but there is nothing to prevent him from starting tapping before they are of sufficient girth to make it worth his while. Instances of too early tapping have come to light, and the usual excuse advanced by the smallholder is necessity. 'And that knows no law', says Mr Fairweather.

This question has not been lost sight of and in any review of the conditions governing the operating of the replanting scheme every endeavour must be made to provide for control over the smallholder until his trees are of sufficient girth to permit tapping. The tapping of immature trees can do irreparable damage.

Catch cropping continues to be practised on replanted holdings conveniently situated in relation to markets. Among the crops grown are water melons, bananas, tapioca, groundnuts and sweet potatoes. On new planted areas, Chinese smallholders show a preference for tobacco.

In one area of Johore where water melons were grown on replanted holdings a return of between $500 and $700 per acre was obtained. However, the rules applicable to catch cropping and inter-cropping have to be strictly enforced, otherwise smallholders plant their catch-crops close up to the line of young trees with consequent retardation of the rubber.

Last year a total of 76,383 acres were replanted and new planted on smallholdings under grant. Under replanting 67,853 acres were replanted with rubber and 1,703 with approved other crops. The new area replanted with rubber totalled 6,826 acres.

In addition, 1,663 acres were recorded as excess replanting of rubber, that is, replanted without the assistance of a grant, and 33 acres with approved other crops.

The overall acreage replanted and new planted including excess was 78,079 acres. This compares with the overall total acreage figure of 76,725 for 1959, an increase of 1,354 acres — a new record.

As at December 31 last year, the total area replanted and new planted with rubber on smallholdings, including excess, was 405,370. The target is 500,000 acres by the end of next year.

Many smallholders, who began replanting in 1955 of their first one-third of their holdings, now find that these trees are just about maturing and they are ready to begin replanting their second one-third acreage.

Rubber Statistics

CANADA — MALAYA — SUMATRA — NIGERIA

ACCORDING to figures published by the Dominion Bureau of Statistics in Canada, July consumption of natural rubber declined to 2,371 long tons from 2,445 a year earlier, while that of synthetic rubber rose to 4,581 long tons from 3,948 and reclaimed rubber to 1,183 long tons from 1,008. January-July consumption of natural rubber dropped to 17,797 long tons from 21,717 a year ago and reclaimed to 9,484 long tons from 10,040, while that of synthetic rubber advanced to 34,497 long tons from 32,772.

Production in July of synthetic rubber amounted to 13,843 long tons against 12,824 year ago, bringing production for the seven months ended July to 95,007 long tons, against 92,731 year before. Reclaimed rubber produced in July this year amounted to 371 long tons against 547 year ago and in the seven months to 3,301 long tons, compared to 3,742 year ago.

Malaya

Malayan shipments of sheet and crepe rubber rose to 97,052 tons in August from 85,931 tons in July. Of the latest total the UK took 12,374 tons, USA 13,258, West Germany 8,217, Japan 8,448, USSR 14,426, China 167, other European countries 23,060, other Commonwealth countries 8,681 and other countries 8,421 tons.

Latex and revertex shipments totalled 9,022 tons in August against 8,244 tons in July.

Sumatra

Total rubber exports from Palembang, South Sumatra, in the January-May period of this year were 48,863 tons, according to a spokesman for the South Sumatra Smallholders Rubber Service. This represented a sharp increase on the figures for the corresponding period of 1960. Smallholder exports came to 35,765 tons.

Nigeria

Rubber exports from Nigeria in May 1961 totalled 2,884 tons compared with 2,601 tons in April and 2,768 tons in May 1960.

Of the May 1961 total, the UK took 1,088 tons, Western Germany 418 tons, Czechoslovakia 260 tons, USA 199 tons and other countries 919 tons.

Plantation Share Survey

LIKE the rest of the other sections of the stock market over the past month or so, the rubber plantation division has passed through a very quiet and at times a very thin time. Despite the many good yields that some of the shares of the big companies now offer, investors on the whole have not shown very much interest although the occasional news item from one boardroom or another has caused a small flutter or two. During the recent lull the International Rubber Study Group has announced that world production of natural rubber in the first five months of this year amounted to 812,500 tons. In the same period — that is between the beginning of January and the end of May — world consumption was estimated at 827,500 tons. The deficit, however, was almost made good by the deliveries of 10,000 tons from the Government stockpiles of both the United States and the United Kingdom. Although, on the face of it, these figures appear satisfactory, looking still further back the overall position compares unfavourably with that of last year. During the January to May period on that occasion production amounted to 800,000 tons or 65,000 tons short of consumption of 865,000 tons. The current drastic cut back in world consumption is due to diminished requirements in the United States where use of the natural material flattened out to 170,000 tons compared with 222,000 tons. At the same time imports to China were deflated from 81,000 tons to 29,000 tons. In the rest of the world on the other hand the trend of consumption continued to expand which must be a shaft of hope to some of the dealers of Mincing Lane.

Meantime, it is now known that the London price of rubber for the month of August ranged from between a 'low' of 24⅜d. per lb. to a 'high' of 25⅞d. per lb. which in itself was indeed a narrow enough range. But at least it showed some improvement from the earlier levels which were established. The average for the month worked out at 25⅛d. per lb. as against a level just under the 25d. per lb. mark in the months of both June and July. Dealers found it difficult to explain the rise, modest though it was, and the general view was that the higher levels would not be sustained for any great length of time American consumption of natural rubber in the month of July, it is worth noting at this juncture, declined to 30,600 tons — or 27.8% of the total for natural and synthetics — and was the lowest monthly figure since 1946.

Among the recent batch of dividends in the rubber section came news of cuts in payments to shareholders. In most instances they covered a period during which the average price of rubber fell by about 4d. per lb. MERLIMAU PEGOH, for instance, sent word to the Stock Exchange of its decision to reduce the dividend from a total of 25% to 20%. BEKOH CONSOLIDATED RUBBER, at the same time, said that their payment was to come down 2½% to 12½%. In contrast it must also be reported that KUALA PERGAU RUBBER and PRANG BESAR RUBBER are both maintaining their previous rates which, in the circumstances prevailing in the past year, is a bull point to the two boards.

PRANG BESAR RUBBER, which is well known throughout the industry as a supplier of high grade planting material, increased its crop last year from 3,212,000lb. to 4,104,000lb. Profits of the group went up to £231,200, compared with £211,600, and this in spite of the fact that selling prices were lower. The dividend of 50% absorbed £61,250 from net profits after tax of £143,100. Replanting and replacement spending amounted to £20,500, indicating a further buttressing of an already strong financial position. The issued capital of the company is only £200,000, and out of proportion to its importance. The capital basis, in fact, represents no more than £32 per acre of rubber and the 2s. shares which are now offering a return of something like £15 on every £100 invested, look one of the more interesting holdings in the rubber section at the moment.

Fifty years of business was celebrated in the right style by the directors of MAJEDIE (JOHORE) RUBBER, now a holding concern with the bulk of its interests in the plantation field. The dividend is going up from 20 5/6% to 25%. On the basis of market prices on March 31 when the group's accounts were made up, the break up value of the 1s. units worked out at 3s. 5d. However, three months later, owing to the fall in rubber share values, the assessment has been trimmed to 3s. The board proposes to take over the assets of BRAE (HOLDINGS), another firm with large interests in rubber and also tea. The exchange terms have been worked out as follows: seven Majedie for every four of Brae's. This plan should have a strong appeal to the members of both companies, since there is no market in Brae and holders obtain a quoted security, while the benefits to the bidders include a wider market as the result of an almost doubled issued capital and a rather broader investment portfolio.

At last . . . after many months of waiting the directors of LONDON SUMATRA have announced that acceptances of the offers made to the members of six other plantation companies owning estates in Indonesia have exceeded 90% of the issued capitals in four cases. These were CENTRAL SUMATRA RUBBER, SIALONG RUBBER, NAMOE TONGAN RUBBER and BAJOE KIDOEL RUBBER. It is intended to acquire the balance of the shares of these companies under the provisions of Section 209 of the Companies Act 1948. Of the publicly held shares in BAH LIAS RUBBER and DJASINGA RUBBER, acceptances total 90% and 89% respectively. Since the offers remain open for the time being there can be little doubt that the whole operation will be completely successful and that the six companies will in due course become wholly-owned subsidiaries of London Sumatra which is, of course, the largest of the British companies, in terms of planted acreage.

Despite the fact that the rubber harvest of KURUNEGALA RUBBER, one of the smaller producers of Ceylon, showed an increase of 9%, conditions in other respects were not satisfactory, particularly in respect of sale prices and tax. In these circumstances its shareholders must have been more than pleased that the dividend is to stay at 7½% for another year. The average yield from the group's plantation of almost 600lb. per acre from the mature rubber is not unreasonable since over half the area tapped was planted in 1904, and by all accepted standards must now be well past its best, if not nearing obsolescence. The profit of £5,252 is fully distributed, the dividend absorbing £4,400 with tax, while over £800 was spent on replanting. The company is now left with a working capital balance of just under £10,000 equal to £12½ per acre on the cultivated areas of 626 acres rubber, 131 acres of coconuts and 42 acres of other crops. The capital cost works out at £55 per acre.

BOOK REVIEW

Trade Names of Rubbers, Resins and Plastics

The first supplement to Information Circular 452, Trade Names of Rubbers, Resins and Plastics, Vol. 3, has just been issued by the Rubber and Plastics Research Association.

This publication lists all the new trade names of rubbers, resins and plastics collected in the library at Shawbury during 1960. Together with IC 372, 426 and 452 it represents a complete index of all materials which have come to the notice of the association since 1926.

The new supplement, which consists of 64 pages, follows the same style as IC 452. One alphabetical list gives the names — which include registered trade marks, trade marks for which applications for registration which have been accepted and coined words used in connexion with the marketing and advertising of such products. Also included is a description of each material and the name and address of the manufacturer or supplier.

The supplement is available to members of RAPRA free of charge, and to non-members for 21s. post paid.

Rubber Markets

LONDON

United Kingdom rubber prices finished a rather quiet week virtually unchanged on balance. Once again the market was inclined to follow the fortunes of Singapore, where news of two Russian steamers — one due to arrive in early October and the other scheduled to load in the second half of the month — caused values to harden before profit-taking and switching set in.

The landed market started the week with a fairly good turnover, but interest subsequently waned. Dealers reported only sporadic interest in the cif market, although it was noted early in the period that Scandinavian and Continental enquiries were circulating. Factory demand showed no improvement and was mainly of a routine nature traders said.

Latest prices are as follows:

No. 1 RSS Spot: 25d.-25¼d.
Settlement House:
November 25d.-25¼d.
December 25d.-25¼d.
January 25d.-25¼d.
January/March 25⅛d.-25⅜d.
April/June 25¼d.-25½d.
July/September 25¼d.-25½d.
October/December 25¼d.-25½d.
No. 1 RSS cif basis ports:
October 24⅞d.-24⅞d.
November 24⅞d.-24⅞d.
Godown:
October 84¼ Straits cents.

LATEX

Centrifuged 60% latex per gallon in drums, seller, October, November, 14s. 4d., cif European ports. Spot, seller, 14s. 10d. Bulk, seller, d.w. 14s. 4d. Normal, seller, October, November, 11s. 2d.

NEW YORK

The New York rubber market ruled as under on October 2:

DEALERS' PRICES

	US cents per lb., ex-dock	
	Oct. 2	Previous
No. 1 RSS, Oct.	29⅛b–29⅜a	29⅛b–29⅜a
Nov.	28⅞b–29⅛a	29b –29⅛a
No. 2 RSS, Oct.	29b –29⅛a	29⅛b–29⅜a
Nov.	28⅞b–29a	28⅞b–29⅛a
No. 3 RSS, Oct.	28⅞b–29⅛a	29b –29⅛a
Nov.	28⅞b–28⅞a	28⅞b–29a
No. 1 RSS, Spot	29⅛n	30n
No. 3 amber blanket crepe, Oct.	26⅛n	26⅛n

FUTURES — REX CONTRACT

	October 2	Prev. Close
Nov. ..	29.10b–29.45a	29.30b–29.45a
Jan. ..	28.60b–28.85a	28.90b–29.10a
March ..	28.55b–28.65a	28.75b–29.00a
May ..	28.50b–28.56a	28.70b–28.85a
July ..	28.40b–28.55a	28.65b–28.90a
Sept. ..	28.40b–28.55a	28.65b–28.90a
Nov. ..	28.40b–28.55a	28.65b–28.90a

Sales: Eight. Tendency: Barely steady.

Futures were steady in very quiet dealings on October 2. Physical rubber was quiet and steady. In late trading, futures were barely steady.

SINGAPORE

Lacking a lead from overseas, the market was slow to open on October 2. Today being the first day for registering October tenders, dealers were inclined to await the effect of the initial tendering. Although registrations were fairly heavy, they had little effect on prices, the market ruling quietly steady throughout the morning. Interest in lower sheets was small and dealings in off-grades were meagre. Extremely quiet conditions ruled throughout the afternoon and prices showed little change. Lower sheets were in little demand.

	Malayan cents per lb., fob Malayan ports to open ports	
	Oct. 2	Prev. Close
No. 1 RSS, Oct. ..	84 –84¼	84¼–84½
Nov. ..	84¼–84½	84¼–84½
No. 2 RSS, Oct. ..	83¼–83⅝	83¼–84
No. 3 RSS, Oct. ..	81½–82	81⅞–82⅛
No. 4 RSS, Oct. ..	80½–81¼	80½–81½
No. 5 RSS, Oct. ..	76¼–77¼	76½–77½
No. 1 RSS, Spot ..	83⅛–84¼	83⅞–84⅛
No. 3 blanket thick remilled crepe, Oct.	75 –76	75 –76
No. 1 fine pale crepe, Oct.	93 –94	92½–93¼
2X thin brown crepe, Oct.	72¼–73¼	72½–73¼

Tendency: Quiet.

The Industries Syndicate quote latex, native produce, 60% centrifugal, packed in rectangular drums, fob, at 165.20d. per gallon.

AMSTERDAM

The Amsterdam rubber market ruled as under on October 2:

	Guilders per kilo	
No. 1 RMA	Oct. 2	Previous
September ..	2.36	2.36
October	2.36	2.36
November ..	2.36	2.36
December	2.36	2.36
October/December	2.36	2.36
January	2.36	2.36

Sales: Nil. Tendency: Very quiet.

DJAKARTA

	Rupiahs per kilo	
	Oct. 2	Previous
Spot No. 1 Priok ..	35.50b	35.50b
Spot No. 2 Priok ..	34.50b	34.50b
Spot No. 3 Priok ..	33.50b	33.50b
No. 1 fine pale crepe, spot	34.00b	34.00b

Tendency: Quiet.

CEYLON

The price of No. 1 RSS at Colombo on October 2 was 101¼ (101¾) Ceylon cents per lb.

BANGKOK

The price of No. 1 RSS at Bangkok on October 2 was 27.12½ (26.87½) US cents per lb.

CROP RETURNS

Unless otherwise indicated, the figures quoted, to the nearest thousand lb., represent crop returns for the month stated and for the number of months of the planting company's financial year to date. Corresponding figures are given in parentheses.

RUBBER ESTATE AGENCY
August

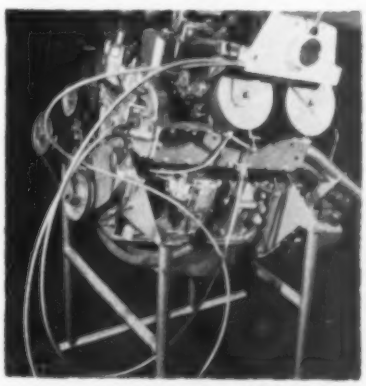
Malayan Crop—3,186 (3,108). 11 mths—37,706 (32,455).
East Sumatra Crop—255 (319). 11 mths—3,242 (3,450).
Bandar Sumatra—82 (90). 1 mth—82 (90).
Bettu Kawan—66 (62). 12 mths—717 (730).
Kepitigalla—69 (87). 5 mths—334 (309).
Langkat Sumatra—35 (67). 8 mths—538 (603).
Tambira—116 (106). 2 mths—240 (215).
Amalgamated Rubber—36 (27). 8 mths—358 (322).
Java Rubber—25 (30). 8 mths—610 (655).
Soember Ajoe—7 (20). 11 mths—213 (200).
Sennah—116 (132). 8 mths—1,110 (1,074).

HARRISONS AND CROSFIELD LTD.
August

London Sumatra Group.—3,822 (3,981). 5 mths—18,322 (17,600).
London Asiatic Group.—2,476 (2,404). 8 mths—19,081 (17,936).
Pataling Group.—1,966 (1,863). 10 mths—18,133 (17,536).
Golden Hope Group.—1,158 (988). 6 mths—6,455 (5,490).
Castlefield.—354 (281). 2 mths—714 (576).
Holyrood.—102 (96). 8 mths—725 (676).
Hong Kong.—37 (35). 8 mths—280 (247).
Hoscote.—290 (267). 2 mths—601 (548).
Killinghall.—48 (49). 2 mths—94 (96).
Kuala Selangor.—73 (74). 8 mths—508 (537).
Malaysia.—72 (63). 8 mths—518 (463).
Prang Besar.—343 (355). 5 mths—1,628 (1,643).
Seaport.—107 (88). 2 mths—214 (162).
Malayalam.—628 (735). 5 mths—3,592 (3,458).
Lunuva.—89 (121). 8 mths—661 (795).
Sandac.—63 (78). 5 mths—291 (348).
Tanah Datar.—79 (90). 8 mths—563 (545).

CHARLES BARKER AND SONS LTD.
August

Glenmarie—101 (83).
Sungei Gumut—34 (23).
Rinching—75 (79).



The control cables, supplied by Teleflex Products Ltd., fitted to this engine are sheathed in small-bore tubing made from Rigidex HD polythene, which allows them freedom of movement and protects them from oil and moisture

Industry INTELLIGENCE

Technical Data

Polidene Emulsions

Polyvinylidene chloride emulsion coatings provide an excellent barrier to grease, oils and odours. They are expected to find wide applications in the packaging and allied industries.

Scott Bader and Co. Ltd., Wollaston, Wellingborough, Northants, is now able to produce these emulsions in freely available quantities and a technical leaflet dealing with the uses of the emulsions has been prepared.

Apart from packaging, the emulsions, to be sold under the trade name Polidene, should find many uses in paints, lacquers, textile treatments, heat-seal adhesives and coating of concrete and linoleum.

The polymers have good fire resistance, non-blocking properties and flexibility.

Perkadox IPP

Small-scale production of di-isopropyl peroxy dicarbonate has recently been announced by Novadel Ltd., St. Ann's Crescent, Wandsworth, London, S.W.18.

This material is to be marketed by the company under the trade name Perkadox IPP and applications include its use as a catalyst for the polymerization of vinyl monomers, allyl and acrylic esters, olefines and polyesters.

The material decomposes spontaneously at room temperature and must be stored at temperatures below 0°F. (−18°C.). It is usually used in solution either in a monomer or in an inert solvent. Data on the half life time of Perkadox IPP in a variety of solvents and notes on its uses and properties are given in a data sheet available from Novadel at the address given above.

Nitrile/PVC Blends

Two technical reports recently issued by Polymer Corporation Ltd., and available from Polymer (UK) Ltd., Walbrook House, Walbrook, E.C.4, describe Polysar Krynac 803 compounds blended with pvc.

Report No. 61:7B describes the compounding of an ozone resistance material with good elastic properties by combining the effects of small amounts of pvc with those of an antiozonant plasticizer and an antioxidant.

Report No. 61:7C gives mixing procedure and properties of a nitrile/pvc blend developed to meet the current demand for rubber compounds with a leather-like appearance. Such materials are used in the manufacture of shoe uppers, briefcases and suitcases. They must calender well, adhere firmly to fabrics, retain simulated leather-grain patterns while curing and remain flexible and waterproof in service.

An index of Polysar technical reports issued since May 1957 has also been issued. Those issued prior to this date are out of print — the information contained in them is printed in the Polysar Handbook.

Polyflo Processing Aid

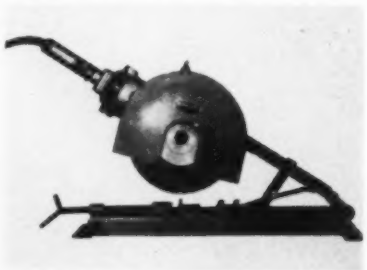
Croxton and Garry Ltd., 27 St. James Road, Kingston-on-Thames, Surrey, has recently been appointed sole UK agent for the distribution and sale of Polyflo, manufactured by Moore and Munger Inc., 33 Rector Street, New York 6.

Polyflo is an additive for polythene and polypropylene which increases the melt index and rate of spiral flow. The material is a blend of polymers and advantages claimed for it include: improved mouldability and extrudability; 15-30% increase in production; improved colour dispersion; reduced moulded-in strains; improved quality of scrap and reprocessed material. The properties and methods of use of Polyflo are described in Technical Bulletin No. P02/1, available from Croxton and Garry.

Machines, Materials and Equipment

Portable Cut-off Machine

A new 1½hp lightweight cut-off machine has been designed by Black and Decker Ltd., Harmondsworth, Middlx. Named the Portacutta, it incorporates a Black and Decker power



unit which gives enough power for cutting angle iron, tube, steel strip, bar or conduit tube and cable. The unit is completely portable, weighing only 48lb. complete, and can be mounted on a bench or on a folding floor stand.

The power unit gives 6,000rpm for a power input of 1,060 watt, and is available for 32, 50, 110, 200/220 and 230/250 volts. It incorporates welded steel base and quick release guard. All motor bearings are dust sealed.

Aerialite Heating System

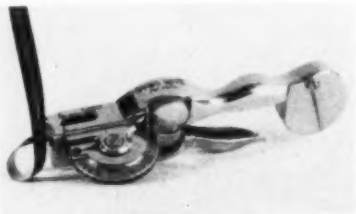
Aerialite Ltd. has introduced a new electric warm air central heating system which is said to be suitable for new and existing property. The company claims that it gives a faster increase in room temperature from cold, all over warmth in winter — cooling in summer and a safe and clean installation.

It comprises an electrically operated, heat producing unit which is fitted into any enclosed space and distributes warm or cool air, through ducting, into any selected room. It is controlled by a time switch and room thermostat, so as to ensure that warmth is obtained when required. Air passes into the rooms quietly, without creating draughts, through grills. The heating of any particular room is selected by a simple adjustment to the register.

Further information can be obtained from the company at Castle Works, Stalybridge, Cheshire.

Dymo-Mite Embossing Tool

Hellermann Ltd. has introduced the Dymo hand-embossing tool in kit form, which will enable labels to be produced either horizontally or verti-



cally. The Dymo tool, which embosses labels on a wide range of various colour pvc tapes, can now be supplied with two separate dies that can be interchanged. Dymo tapes are available with or without adhesive backing.

Further information can be obtained from the company at Gatwick Road, Crawley, Sussex.

Publications

I.C.I. Dumb-bell Recorder

A pamphlet just produced by I.C.I. Ltd. is reprinted from Transactions of the IRI and is entitled 'Autographic Measurement of the Stress-Strain Properties of Dumb-bell Test-Pieces'.

Written by A. G. Buswell, B.Sc, Dyestuffs Division I.C.I. Ltd., the booklet describes the I.C.I. dumb-bell recorder, as fitted to a standard pendulum machine.

The errors in stress measurement when using a pendulum system are discussed and a system for measuring the stress/strain properties of dumb-bell specimens, combining the I.C.I. dumb-bell recorder with a low inertia stress measuring device described. The advantages of such a system are demonstrated.

Synthetic Rubber Prices

Prices of synthetic rubbers appear regularly in RUBBER AND PLASTICS WEEKLY *on the first week of each month. It will be appreciated if suppliers will give notification of any price changes or additions to their range. C/f duty paid quotations are subject to slight variation due to exchange, ocean freight and insurance fluctuations. Prices are in pence per lb., except where otherwise stated. Grades are expressed as follows: 1001/2/6 = grades 1001, 1002 and 1006.*

(e-qdp)—Ex-quay duty paid (cifUKdp)—cif UK duty paid (e-i)—Ex-installation (ddp)—Delivered duty paid (e-sUK)—Ex-store UK (ex-wUK)—Ex-warehouse UK (d)—Delivered BM—black masterbatch CBM—cold, black masterbatch CNP—cold, non-pigmented CNS—cold, non-staining COE—cold, oil extended COELC—cold, oil extended, light coloured CO/BM—cold, oil/black masterbatch CPOE—cold, pigmented, oil extended CRE—cold, rosin extended dw—Dry weight HN—high nitrile HNP—high nitrile, powder HP—hot, pigmented HS—high styrene HMW—high mol. wt. LMW—low mol. wt. MHN—medium high nitrile MLN—medium low nitrile MMW—medium molecular weight MN—medium nitrile NS—non-staining TS—total solids RTV—room temp. vulc.

SBR TYPES AND HIGH-STYRENE RUBBER

Ameripol (Goodrich Gulf) (e-qdp)

1000/1/6/7	Hot, non-oil	22.50
1002/12	,, ,,	22.75
1009	,, ,,	24.25
1011	,, ,,	23.25
1013	,, ,,	23.50
1019	,, ,,	24.75
1006/12	Hot, crumb	23.00
1009	,, ,,	25.00
1013	,, ,,	24.00
1500/1/2/9/11	Cold, non-oil	22.50
1605	BM, cold, non-oil	18.75
4658	,, ,, ,,	19.25
1606/8	,,	18.25
1609	,,	20.25
1610	,,	18.75
4651	,,	17.75
4600G2, 4604	Cold, non-oil	22.50
1703	COE, 25% oil	19.75
1705	,, ,, ,,	19.50
1707/8	,, 37.5% ,,	18.25
1710/12	,, ,, ,,	18.00
4700	,, 50% ,,	16.75
4760	COBM, 17.5% oil	16.25
1805	,, 37.5% oil	16.00
1809	,, ,, ,,	15.75
4756	,, ,, ,,	15.75
4759	,, ,, ,,	16.25
1808	,, 50% ,,	15.25
4758	,, 62.5% ,,	15.00

ASRC (American Synthetic Rubber Corpn.) (e-sUK)

1004/6	Hot, non-oil	22.25
1009	,, ,,	24.0
1018	,, ,,	24.75
1019	,, ,,	24.5
1500/2/7	Cold, non-oil	22.25
1503	,,	24.25
1703	COE	20.5
1708	,,	18.0
1712	,,	17.75
1713	,,	16.75
3014	Hot, non-oil	25.75
3105/6	Cold, non-Oil	22.25
3110	,, ,,	24.0

Cariflex (Shell Chemical) (e-sUK)

S-1000	Hot	22.25
S-1002	,,	23.375
S-1006	,,	22.25
S-1009/11/13	,,	24.0
S-1500/2/9	Cold	22.25
S-1600/2	CBM	19.625
S-1605	,,	19.375
S-1606	,,	18.75
S-7652	,,	20.0
S-1703	COE	19.25
S-1707	,,	18.0
S-1709/12	,,	17.75
S-1803	COBM	17.875
S-1806	,,	16.625
S-1807	,,	17.375
S-1808	,,	15.25

Contract terms available.

FR-S (Firestone) (delUK*)

1000/1/4/6/7 and 195	Hot	22.50
1500/2 and 146	Cold	22.50
1703 and 173	OE	19.11
1710/12 and 184	,,	18.00
178	,,	18.25
201	,,	16.71
1009 UK Specialty		23.06
1012 ,, ,,		22.59
1013 ,, ,,		23.59
1014 ,, ,,		26.18
181 ,, ,,		22.50
182 ,, ,,		23.29
147 ,, ,,		20.94
158 ,, ,,		28.00
158-S		27.50

*Import Duty not included

Int. Synthetic Rubber (d)

Intol 1500/2	22.5
Intol 1509	22.5
Intol 1570	23.5
Intol 1006	22.5
Intol 1710	18.0
Intol 1712	18.0
Intol 1778	18.25

Naugapol (Naugatuck Chemical International) (ex-WUK)

1016/9	28.5
1018	29.0
6003	29.0
1022	32.25
1023	34.5
1503	28.25
6102	28.25
1504	36.5
6101	24.5
6100	33.5
K-45	28.25
K-50	28.75
KO-50	29.25
1015	36.5
6004	27.0

ANIC (e-qdp)

1500	22.25
1502	22.25
1708	18.00
1712	17.75
6630	23.25
6632	22.25
6700	16.375

Philprene (Phillips) (d)

1000/6	Hot, non-pig.	22.50
1009	,, ,,	23.06
1018	,, ,,	24.99
1019	,, ,,	24.56
6701	,, ,,	22.50
1500/2	CNP	22.50
1503	,,	24.35
6630	,,	23.75
6632	,,	22.50
1601	CP	19.70
1603	,,	19.25
1605	,,	18.75
1606	,,	18.25
1608	,,	18.75
1609	,,	21.27
6655	,,	19.25
1703	COE	19.50
1708	,,	18.25
1712	,,	18.00
6700	,,	16.85
1803	CPOE	18.13
1805	,,	16.00
1808	,,	15.50
6608	,,	15.33
6753	,,	15.50
6754	,,	15.25
6755	,,	17.50

Plioflex (Goodyear) (ex-wUK)

1006	Hot, non-oil	22.25
1019/1503	CNP, electrical	22.25
1500/2/7/10	CNP	22.25
1006S		22.75
1712C	COE	17.75
1708/78	,,	18.00
1713/15	,,	16.25
1714C	,,	16.00
1773	,,	19.25
224	HS(d)	27.00

Polysar (Polymer UK) (e-sUK)

S/S-630 Hot	22.50
Krylene	22.50
Krylene NS	22.50
Krylene 602 Cold	22.50
Krynol 651 COE	18.00
Krynol 652/4 ,,	18.25
Krynol 653 ,,	18.00
S-X 371 Process Aid	24.08

Synpol (Texas-USChemical) (e-qdp)

1000/1/6/7/61/61C	Hot	22.25
1009	,,	22.81
8000	,,	22.25
1500/2/51	Cold	22.25
8104	,,	22.25
1703	COE	19.25
1707/8/8200	,,	18.00
1712	,,	17.75
8201/8	,,	16.59
8202	,,	16.38
8209	,,	19.16
1606	CBM	18.20
1608	,,	18.45
1806	COBM	15.84
1808/8255	,,	14.80
8257	,,	14.96
1814	,,	15.45

(Masterbatch prices US cents per lb. fas Gulf ports)

SBR LATICES

Copo (Copolymer) (cifUKdp)

(10-ton lots)

2101	(dw)	46.3
X-765	,,	40.8
X-800	,,	37.2
2102/5	,,	38.0

Ciago

SB75	38.00
SB69	36.00
SB57P BM	27.50
SB58P	29.75

Pliolite Rubber (Goodyear) (d)

2000	40

Latex (dw)

2001/4/5/8	40
5350	40

Pliolite Resin (Goodyear) (d)

101A (dw)	44
150 ,,	50
151 ,,	35
160 ,,	50
170 ,,	50

Hycar (B. F. Goodrich) (ddp)

2507 (HS) dw	48

Polysar (Polymer UK) (e-sUK)

Latex, type IV	32.50 TS
Latex, type 722	31.75 TS
Latex, type 741	36.00
Latex, type 781	68.00
(Non-returnable 45-gallon drums)	
Latex, type IV	29.00
	(e-i)
Latex, type 722	27.00 TS
Latex, type 723	27.00
(bulk quantities)	

Int. Synthetic Rubber (ex-wks)

Intol Latex M23B/R23/F28	22.25
Intol Latex 62A	27.0

Dylex (Koppers Int. CA) (fas)

K-42A/52/31/900	31.6

ACRYLONITRILE TYPES

Butaprene N (Firestone) (cifUKdp)

NL	52.5
NAA	56.25
NF	51.5
NXM	60.18

Chemigum (e-s)

N—1	75
N—3A	52
N—5	52
N—6G/7/8/600X	45

Hycar (British Geon) (UKd)

(500-lb. lots and over)

1001 High Nitrile Hot	52
1041 ,, ,, Cold	52
1002 MHN Hot	45
1042 ,, Cold	45

Hycar (B. F. Goodrich) (ddp)

(500-lb. lots and over)

1411 HNP	66
1432 MHN (crumb)	64
1072 ,, (carboxyl)	66
1312 ,, (liquid)	55
1043 MLN	51
1014 Low Nitrile	61

I.C.I. (min., 5-cwt. lots) (UKd)

Butakon A-4051 HN Cold	52
Butakon A-3051 MN Cold	45
Butakon A-3002 ,, ,,	45

Paracril (US Rubber) (dwe-sUK)

18-80 Low Nitrile	61
AJ ,, ,,	50
B MLN	51
BJ ,,	51
BLT ,, Cold	51
BJLT ,, ,,	51
C MHN	59
CLT ,, Cold	59
CV ,, (crumb)	63
D High Nitrile	67
ALT	51
OZO	47

Polysar (Polymer UK) (d)

Krynac 800 MN	45
Krynac 802 LN	45
Krynac 803 MN (low Mooney)	45
Krynac 801/5 HN	52
Krynac 804 (MN-cross linked)	45

ACRYLONITRILE LATICES

Butaprene N (Firestone) (cifUKdp)

N-300 (dw)	53
N-400 ,,	60.5

Chemigum Latex (Goodyear) (d)

200 (dw)	65
235/6 CHS ,,	60
245 B ,,	52
245/6/7/8 CHS ,,	52

Ciago

AB61/71	60
AB62/77	52
217OH	60

Hycar (B.F. Goodrich) (ddp)

(dry weight, drum lots)

1551 High Nitrile	66
1552 MHN	57

Hycar (British Geon) (UKd)

(dry weight, 3 drums and over)

1561 High Nitrile	60
1571 ,, ,, (carboxyl)	60
1562 MHN	52
1577 (modified)	52

ACRYLIC TYPES

Hycar (B. F. Goodrich) (ddp)

4021 Slab, 500 lb. and over	144
4501 Latex, dry weight	96

BUTYL TYPES

Esso (e-sUK)

Regular 035/150/215	21.75
Regular 217/8	21.75
Regular 325	21.75
Non-staining 165	22.75
Non-staining 268	22.75
Non-staining 365	22.75

Polysar (Polymer UK) (e-sUK)

Butyl 100/200/300		21.75
Butyl 301/400	NS	21.75
Butyl 101	NS	26.25
Butyl 402	NS	22.5
Butyl 600	NS	25.75

Hycar (B. F. Goodrich) (ddp)

(500 lb. and over)

2202 Brominated	68

ISOPRENE RUBBER

Shell Chemical Co. (e-sUK)

Cariflex I-300	26.5
Cariflex I-500 OE	23.5

POLYBUTADIENE

Int. Synthetic Rubber (UKd)

Diene 35	27.0
Diene 50	27.0

NEOPRENES

Du Pont (UK production)

W	(del)	38.5
WHV	,,	37.0
WX	,,	40.5
WRT	,,	44.0
GS	,,	41.0
GRT	,,	42.0

(USA production)

AC/AD	(del)	57.125
S	,,	45.625
KNR	,,	75.625
CG	,,	57.125

Latices (UK)

842A	(dwdel) 45-gal. drums	41.0
842A	,, 2,000-gal. tanker	36.0
601A	,, 45-gal. drums	45.0
601A	,, 2,000-gal. tanker	40.0

Latices (USA)

60	(dwdel) 45-gal. drums	51.875
400	,, ,, ,,	54.125
571	,, ,, ,,	49.75
572	,, ,, ,,	51.25
635	,, ,, ,,	53.625
650	,, ,, ,,	54.125
673	,, ,, ,,	62.0
735/6/50	,, ,, ,,	51.25
950	,, ,, ,,	58.25

Polysar (Polymer UK) (e-sUK)

SS-250 HS (bale)	27.00
SS-250 ,, (flake)	27.25
S-X370	23.75
S-X371	24.25
SS-260 (flake)	29.25
Kryflex 200	23.75
Kryflex 252 HS	25.25
Kryflex 202 (HMW Cold polymerized)	23.50

Cariflex (Shell Chemical) (e-sUK)

SP-103	27.25

Cyclite (Durham Raw Materials) 42

HYPALON (ddp)

20	48
30	60.25
40	50.75

SILICONE RUBBERS

Midland Silicones

(500-lb. lots del)

Stocks	16s. 6d. to 35s.
Pastes	26s. to 35s.
Gums and base stock	36s. to 42s.
Cold-curing silicone rubber	20s. and 23d. 6d.

I.C.I. Silicones

Gums (40-lb. lots del) 39s. 6d.-47s.
Stocks (250-lb. lots del) 22s.-35s.
Pastes (1000-lb. lots del) 27s.6d.-35s.9d.
Silcoset (RTV) (250-lb. lots del) 21s. to 24s.

REINFORCING RESINS AND RUBBERS

I.C.I. (min., 2-ton lots) (UKd)

Butakon S-8551	36.5
Butakon S-7001	33.5

Hycar (B.F. Goodrich) (ddp)

2007 (powder)	42.5

Pliolite (Goodyear) (d)

S—6B	36.5

IRI GOLF

Scottish Section at Balmore

THE IRI Golfing Society Scottish section's last outing for the season took place at Balmore, when the section was host to the Plastics Institute in the second match for the 'Dick Trophy'. A sharp shower welcomed the early starters, but after this conditions overhead were very pleasant although it was a little heavy underfoot.

The PI came out on top, and with the PI also having won the earlier game in May, they became the winners of the Dick Trophy for the first time by the comfortable margin of 13 wins to eight with three halved.

Detailed results (IRI names first):

W. Alexander 0 v. P. W. Bell 1; W. Sommerville ½ v. D. Chesney ½; J. Judd ½ v. J. Morton ½; W. Boyd 1 v. S. Rosie 0; L. A. Johnson 0 v. L. Stubbs 1; J. Gallie 1 v. K. Manock 0; J. Campbell 0 v. F. Buchanan 1; Graem Hardie 0 v. D. Milligan 1; W. A. D. Brown 0 v. A. Colquhoun 1; G. Wilson 0 v. J. Scott 1; C. Cook 1 v. J. Davidson 0; and S. Jonker 1 v. A. Carrick 0.

In handing over the trophy, Mr Gallie congratulated Mr Stubbs, the PI chairman and added that, although defeated, he and his colleagues had no regrets and, indeed, were delighted that the cup had at last changed hands. Mr Stubbs replied, concluding by expressing thanks on behalf of all present to the committee and staff of the Balmore Club for their courtesy and service. — J. M. G.

London Section at Highwoods

Twelve members of the London Section of the Institution of the Rubber Industry Golfing Society were present at the autumn meeting held at the Highwoods Golf Club, Bexhill, on Saturday and Sunday September 30 and October 1.

On the Saturday morning the Stableford competition was won by A. M. Keith with 37 points after a tie with C. N. Weller. The four-ball better ball competition in the afternoon was won by A. Smales and C. D. L. Smith with 40 points, the runners-up being E. J. A. Davis and F. L. Davis with 38 points.

The usual match with the Highwoods Golf Club was held on the Sunday morning, resulting in a win for the home side by 4½ matches to 1½.

—C.D.L.S.

IRI NEWS

Tyres on the Motorways

'Tyres on the Motorways' is the subject of a talk to be given at a meeting of the Institution of the Rubber Industry's Merseyside Section at the Central Libraries, William Brown Street, Liverpool, on Wednesday October 11, at 7.30 p.m.

The talk will be delivered by L. S. Mountford (Dunlop Rubber Co. Ltd.) and the chairman of the section, P. F. Pierce, will preside.

'Russian Polymer Technology' will be the subject of a meeting of the section on November 17. Secretary of the section is F. W. Ball, Dunlop Rubber Co. Ltd., Speke, Liverpool 24.

Future Events

Plastics Institute

Scottish Section. — October 10 at the Scottish Building Centre, Sauchiehall Street, Glasgow. 'Current Work of the Rubber and Plastics Research Association of Great Britain', by W. F. Watson (director of RAPRAGB).

South Wales and Monmouthshire Section. — October 11 at the Angel Hotel, Cardiff, at 7 p.m. An evening of films including 'A Good Catch'.

Yorkshire Section. — October 11 at the Hotel Metropole, Leeds. Ladies' evening. 'Hair-styling' by G. Oakes.

Scott Bader Crystic polyester resin is used in the manufacture of the hull, deckhead and coach roof of the Island 20 motor cruiser. Glass reinforced plastic is also used for all interior bulkheads, lockers, berths, seating, partitions and fuel and water tanks

TRADE MARKS

Objections to the registration of any of the undermentioned applications may be lodged with the Comptroller-General of Patents, Designs and Trade Marks at the Patent Office, 25 Southampton Buildings, Chancery Lane, London, W.C.2, within one month of the date mentioned. The objections must be stated on Trade Marks Form No. 7, cost £2, obtainable through any money order office. The extracts—from 'The Trade Marks Journal'—given below are reproduced by permission of the Controller of H.M. Stationery Office.

Esso (810,718). Synthetic rubber. Humble Oil and Refining Co., 100 West Tenth Street, Wilmington, State of Delaware, and 1216 Main Street, Houston, State of Texas, USA. Address for service is c/o D. Young and Co., 9 Staple Inn, London, W.C.1. (Class 17; August 16 1961.)

Terlastic (811,752). Plastics included in Class 17; synthetic rubber; and natural rubber latex. Société d'Electro-Chimie, d'Electro-Metallurgie et des Acieries Electriques d'Ugine, 10 Rue du General Foy, Paris, France. Address for service is c/o Carpmaels and Ransford, 24 Southampton Buildings, Chancery Lane, London, W.C.2. (Class 17; August 16 1961.)

Li-Kit (B815,849). All goods included in Class 17. P. B. Cow and Co. Ltd., Eastbourne Road, Trading Estate, Slough, Buckinghamshire. (Class 17; August 16 1961.)

Osmarail (817,772). Plastics included in Class 17, in the form of rails. Osma Plastics Ltd., Grove House, 551 London Road, Isleworth, Middlesex. (Class 17; August 16 1961.)

Muratex (818,957). Sheet material made of plastics included in Class 17. B.X. Plastics Ltd., Highams Park, London, E.4. (Class 17; August 16 1961.)

Tuffak (819,889). Plastics in the form of sheets, blocks, rods, films and tubes, all for use in manufactures. Rohm and Haas Co., 222 West Washington Square, City of Philadelphia, State of Pennsylvania, USA. Address for service is c/o Stevens, Langner, Parry and Rollinson, 5 to 9 Quality Court, Chancery Lane, London, W.C.2. (Class 17; August 16 1961.)

Changes of Name

South Perak Rubber Syndicate Ltd. (266,243), 53 Eastcheap, E.C.3. Name changed to Mitre Trust Ltd. on March 28 1961.

Stixon Plastic Ltd. (581,642), 39-47 East Road, N.1. Name changed to S. P. Mercantile Ltd. on April 5 1961.

Plastaparal Ltd. (419,748), manufacturers of, and dealers in, fabrics or garments, etc., 310 Regent Street, W.1. Name changed to Martin-White Ltd. on April 4 1961.

Martin-White Ltd. (284,424), hosiers, etc., 310 Regent Street, W.1. Name changed to Plastaparal Ltd. on April 4 1961.

Polychemy Ltd. (357,674), 47 London Road, Kingston. Name changed to Polychem (A.G.) Ltd. on April 4 1961.

Technical Mouldings Ltd. (619,173), 76 South Street, Reading. Name changed to John Histead and Partners Ltd. on March 30 1961.

Movitex Ltd. (686,607), 56 Moorgate, E.C.2. Name changed to Master Fasteners Ltd. on January 19 1961.

Continental Rubber Products Ltd. (566,118), 25 Haymarket, S.W.1. Name changed to Continental Tyres and Rubber Products Ltd. on January 26 1961.

Latest Wills

William Griffin Morris, of Portinscale, Arthog Road, Hale, Cheshire, former chairman of Greengate and Irwell Rubber Co. Ltd., who died on May 6 1961, aged 82 years, left £51,474 net value.

Roland Robert Callingham, FCA, of Chiltern Lodge, Beaconsfield, Bucks, formerly of Balfour House, 119-125 Finsbury Pavement, E.C., a director of Rubber and Industrial Trust Ltd., who died on June 13 1961, aged 81 years, left £72,339 net value.

William Farquhar Sheddon, of The Crown Hotel, Lyndhurst, Hants., late of Malaya, formerly c/o Messrs. Ko Rubber Plantations Ltd., South Canal Road, Singapore, late rubber estate general manager, who died on February 17 1961, left estate in Great Britain valued at £21,639 net value.

CLASSIFIED ADVERTISEMENTS

RUBBER AND PLASTICS WEEKLY

APPOINTMENTS VACANT

8d. a word, Minimum 12/- Box 2/-

ASSISTANT Chief Chemist.—A qualified Chemist/Rubber Technologist required with knowledge of the compounding of synthetic rubbers; experience of plastics technology an advantage. The Company manufactures flexible aircraft fuel tanks, specialized rubber mouldings and a range of commercial containers. — Please write, giving details of age, education, experience, salary, etc., to Personnel Manager, Fireproof Tanks Limited, The Airport, Portsmouth. (064)

CHEMISTS and assistants are required for an increase in development work on joint sealing materials for roads, concrete runways and contemporary buildings. The work will involve the application of plastics and rubber technology, including cold-catalysed systems. Experience or knowledge of drying-oils, bitumen, etc., will also be useful. Good salary. Pension scheme.—Applications in confidence, giving details including salary required to Personnel Manager, Expandite Limited, 1-9 Chase Road, Harlesden, N.W.10. (049)

CHARGE hand required for surgical plastic department. Knowledge of extrusions advantageous.—Write stating age, experience and salary required to Box 054. (054)

FOREMAN required, fully experienced in the compounding of synthetic rubbers and should have first class knowledge of all aspects of calendering. This will be a permanent, progressive position in a rapidly expanding department and the selected applicant will be responsible to the existing Departmental Superintendent. Applicants should have held a similar supervisory position and had a number of years' experience in the above processes. — Please write, giving details of age, experience, salary, etc., Box 065. (065)

EAL EXECUTIVE APPOINTMENTS LIMITED
78 Wigmore Street, London, W.1

PRODUCTION MANAGER Thermoplastics

A long established and well-known company engaged in manufacture of a wide range of rubber and plastic goods seeks a Production Manager to be responsible for manufacture of thermoplastic products. Candidates will be men aged 30-40, with specialist plastics experience (including vacuum forming and mould design) and relevant professional qualifications. Salary in region of £2,000 per annum.

This important post, in a large and progressive organisation, offers considerable scope to a practised manager with detailed knowledge of plastics manufacture (RN. 115B).

Please write briefly in strictest confidence to the Managing Director, quoting the reference number. No identities divulged without permission. (046)

APPOINTMENTS VACANT

(continued)

PRECISION Rubbers Limited have a vacancy for a qualified and experienced chemist/technologist, aged 25-35, to undertake compounding and other development work in connection with synthetic rubbers. This appointment offers considerable scope and interest for a man with initiative and ability.—Apply in writing, giving particulars of age, training, qualifications and salary required to The Technical Director, Precision Rubbers Limited, Bagworth, Leicester. (052)

REQUIRED for small rubber service and research laboratory in Midlands. Young semi-qualified rubber technologist of LIRI standard. Opportunity to acquire extensive knowledge of acceleration of rubber compounds and investigation of compounding problems. Time allowed for study for Associateship. Contributory pension scheme. Nominal 5-day week. Canteen facilities.—Apply giving details of age, education, training, qualifications and experience to Robinson Brothers Limited, Phoenix Street, West Bromwich, Staffs. (047)

RESEARCH and development. A technically qualified man is required to co-ordinate the research and development team of a rubber and plastics manufacturers in Slough. The appointment will be permanent, progressive and contributory pension facilities exist. An initial salary of £2,000 per annum is envisaged.—Applications giving comprehensive details to Group Personnel Advisor, P. B. Cow and Co. Ltd., Eastbourne Road, Trading Estate, Slough, Bucks. (050)

SPONGE production. A chemist with good experience of sponge and a technician similarly qualified are urgently required by growing company in country district. Excellent working conditions and pension arrangements.—Write with full details of career and salary required to Box 463. (463)

WE have a vacancy for a Junior Rubber Technologist in our Manchester factory. The work is varied and interesting and would appeal to those who wish to widen their experience and further their studies under the day-release scheme.—Apply to the Technical Manager, Phillips Rubbers (Manufacturing) Ltd., Bromley Street, Manchester, 4. (063)

WORK STUDY ENGINEER

Owing to promotion a vacancy has occurred in the Work Study Department for an engineer of ONC standard with previous experience of work study.

A knowledge of plastics and/or rubber processing is advantageous.

Applications, which will be treated in the strictest confidence, should be sent to

The Chairman, Rubber Improvement Limited, Rilex House, Chandos Street, London, W.1, marked (W.S.E.). (062)

EXPORT ISSUE

OCTOBER 21 1961

A REMINDER

Advertisers who may wish to place a **small announcement concerning their organisation** in the **Classified Section** of our **EXPORT ISSUE,** are reminded that copy must be received by

11 a.m., TUESDAY OCTOBER 17

Butyl | **SEALANTS LTD**

for

LAMINATES · SHEET · SPONGE · STRIP

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APPOINTMENTS WANTED

8d. a word, Minimum 12/- Box 2/-

QUALIFIED technologist, AIRI, considerable experience moulded, extruded mechanicals, sponge, particularly automotive, seeks challenging executive appointment demanding ability and initiative. Home or abroad.—Box 061. (061)

This column can be YOUR best BUYER or SELLER

RUBBER & PLASTICS

MACHINERY

Why not see for YOURSELF

MACHINERY FOR SALE

8d. a word, Minimum 12/- Box 2/-

'COTSWOLD' dipping machines and circulating tanks for latex and PVC. New catalogues now available on request. Lionel Hook and Sons, Ebley, Stroud, Glos. Tel.: Stonehouse 614/5. (380R)

FOR sale, in splendid condition. 1 horizontal vulcanising pan, 13ft. 9in. x 7ft. 6in. diameter. Quick-lock door, 60 w.p., complete with cariage, loading pans and base stand. Price ex works for quick sale—£500.—Box 066. (066)

FOR sale. Two 2in. Iddon rubber extruders, 7½h.p. variable speed drive. In good condition. £250 each.—Box 067. (067)

FOR sale. 3A Banbury mixer with 24in. conveyor, 42in. x 20in. double geared mill. As new, less than 1,000 running hours.—Box 059. (059)

HYDRAULIC presses, pumps, valves, new, also large second-hand stock.—Thompson and Son (Millwall) Ltd., Cuba St., London, E.14. East 1844. (427)

MANUFACTURERS of roughing machines for rubber sheeting, sponge rubber, splitting machines, leather cloth plant, embossing plates and rollers, spreading machines and presses.—G. L. Murphy Ltd., Imperial Works, Menston, Nr. Leeds. (238R)

PLASTIC injection moulding machine, Windsor 6oz. model SH6. Steam boilers, 200lbs. to 16,000 lbs. evaporation; Economic, Cochran, Lancashire; automatic oil and stoker firing; delivery and installation anywhere. Insurance approved and 12 months' guarantee. Highest part exchange valuations.—Fred Watkins (Engineering) Ltd., Coleford, Glos. Telephone: Coleford 2271 (5 lines). (406)

Donald Learer Limited

1 LONDON ROAD, STAINES, MIDDX. Phone STAINES 55271-2

FOR **SECONDHAND PLANT AND MACHINERY** (1057)

MACHINERY FOR SALE

— PHONE RAINHAM 5655 —

PRESSES - MILLS - PLATENS - ETC.

Guaranteed Secondhand Plant

E. & V. GIBBONS LTD. LAMBS LANE, RAINHAM, ESSEX

(430)

SHAW 60in. x 22in. mill with 100 h.p. drive. 30in. x 24in. and 21in. single geared cracker with 200 h.p. drive. Pair of 50in. x 18in. single geared mills with 140 h.p. drive. Several smaller mills.—Reed Brothers (Engineering) Ltd. (Mr. C. E. M. Hardie—Receiver and Manager), Replant Works, Woolwich Industrial Estate, London, S.E.18. Tel.: Woolwich 7611 (057)

UNUSED 60in. x 22in. single geared mixing mill, friction ratio 1.15 to 1, Vibro mounted, Lunn safety equipment, driven by 125 h.p. slip ring motor.—Box 058. (058)

ARTICLES WANTED

REGULAR BUYERS **P.V.C.** SHEET SCRAP

MICHAEL S. STEVENS LTD

STATION WORKS, 75c UPPER RICHMOND RD., S.W.15

VANDYKE 6925 (739)

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Work can be carried out on a complete supply basis or on customers' own materials.

DAVID MARSH (MANCHESTER) **LTD., Irk Rubber Works**
QUEEN'S ROAD, COLLYHURST, MANCHESTER, 9
Telephone: COLlyhurst 1949/3960 (056)

MACHINERY WANTED

8d. a word, Minimum 12/- Box 2/-

LABORATORY mill, about 12in. rolls.—Box 053. (053)

MELLOR Equipment Ltd., Springfield Lane, Salford, 3, buy used machinery of Francis Shaw and Joseph Robinson manufacture.—Telephone Manchester, Blackfriars 1866. (428)

SMALL vertical steam pan with quick lock door. 3ft. diameter, 3ft. deep, approximately.—Box 051. (051)

STEAM heated drying oven with forced air circulation suitable for tray drying of chemical powders or plastic granules. Operating temperature not less than 170°F, 125-150 cu. ft. capacity in one or not more than two compartments.—Box 048. (048)

MACHINERY WANTED

(continued)

URGENTLY required. 3 press platens, 6ft. 6in. x 4ft. for steam heating. Must be in good condition.—Box 055. (055)

WANTED, 20in. x 20in. cracker mill. Must be in good condition.—Box 060. (060)

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INSTRUCTIONS FOR THE CLASSIFIED ADVERTISEMENTS MUST REACH US BY ***10 A.M. WEDNESDAY MORNING*** *OF EACH WEEK*

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We are able to undertake the bale cutting of your own rubber, either natural or synthetic

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LEYLAND, LANCASHIRE

Telephone : Leyland 21529

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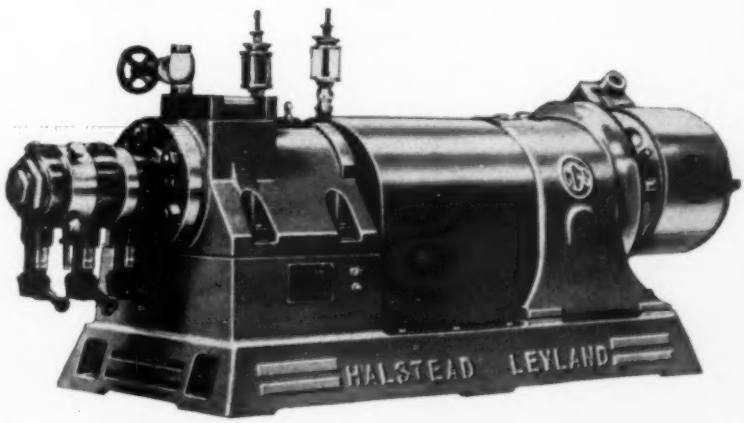

1½" bench type rubber extruding machine with electrically heated extension and die head

INDEX to ADVERTISERS

	Page
Abrasive Developments Ltd.	—
A.E.W. Ltd.	—
Allcock, J., & Sons Ltd.	—
Amalgamated Oxides (1939) Ltd.	—
Anchor Chemical Co. Ltd.	Cover i
Anderson, Joseph, & Sons Ltd.	—
Armour Hess Chemicals Ltd.	535
Associated-Rediffusion Ltd.	—
Astor Boisselier & Lawrence Ltd.	—
Baker Perkins Ltd.	v
Barwell Engineering Ltd.	560
Belgrave Industries (Exports) Ltd.	—
Berk, F. W., & Co. Ltd.	—
Berstorff, Hermann	—
B.I.P. Chemicals Ltd.	—
Birch, Singleton, W., & Sons Ltd.	—
Bone Bros.	—
Boston Marine & General Eng. Co. Ltd.	—
Bridge, David, & Co. Ltd.	Cover ii
Bright, John, & Bros. Ltd.	Cover iii
British Electrical Development Association	—
British Geon Ltd.	—
British Nylon Spinners Ltd.	—
British Recovered Rubber Co. Ltd.	i
British Resin Products Ltd.	—
British Titan Products Co. Ltd.	—
British Transport Commission	—
Bush Beach & Segner Bayley Ltd.	—
Cabot Carbon Ltd.	—
Carter Bros. (Rochdale) Ltd.	—
Carlton Press Knives Ltd.	—
Chance & Hunt	—
C.I.C. Engineering Ltd.	—
Cleggswood Oil Distillery Ltd.	—
Cohen, George, Sons & Co. Ltd.	—
Columbian International (Gt. Britain) Ltd.	—
Consolidated Zinc Corporation (Sales) Ltd.	—
Courtaulds Ltd.	—
Crosfield, Joseph, & Sons Ltd.	—
Croxton & Garry Ltd.	—
Derrick Davis Plastics Ltd.	—
Dietzel, Hugo	—
Distillers Co. Ltd., The	—
Dixon, T. H., & Co. Ltd.	—
Docker, John, & Co. (Engs.) Ltd.	529
Dunlop Rubber Co. Ltd.	—
Du Pont Co. (United Kingdom) Ltd.	—
Durham Raw Materials Ltd.	—
Economist Intelligence Unit Ltd., The	—
Ellison, George, Ltd.	—
English Clays Lovering Pochin & Co. Ltd.	—
English Electric Co. Ltd., The	—
Esso	—
eur-O-matic	—
Fawcett Preston & Co. Ltd.	—
Ferguson, A. O., & Co. Ltd.	x
Ferguson, James, & Sons Ltd.	—

	Page
Ferguson Shiers Ltd.	—
Firestone Tyre & Rubber Co. Ltd.	—
Foamair Ltd.	—
Geigy Co. Ltd., The	—
Goodyear Tyre & Rubber Co. Ltd.	543
Greeff, R. W., & Co. Ltd.	—
Gresham & Craven Ltd.	—
Gummi und Asbest	—
H.F. Industrial Services Ltd.	—
H.K. Import & Export Ltd.	—
Halsteads Engineers (Leyland) Ltd.	559
Hankin, Geo., & Co. Ltd.	—
Hardman & Holden Ltd.	—
Harrison Jones	—
Hatcham Rubber Co. Ltd.	vi
Hay & Robertson Ltd.	—
Hilton, Wallace, & Co. Ltd.	—
Hubron Rubber Chemicals Ltd.	—
Hughes & Hughes Ltd.	—
Hunt Heat Exchangers Ltd.	—
Iddon Bros. Ltd.	vii
Iliffe Industrial Publications Ltd.	—
Imperial Chemical Industries Ltd. (Billingham)	—
Imperial Chemical Industries Ltd. (Dyestuffs)	—
Imperial Chemical Industries Ltd. (Plastics—Alkathene)	549
Imperial Chemical Industries Ltd. (Terylene)	—
Institution of the Rubber Industry	—
International Corporation Ltd.	—
International Synthetic Rubber Co. Ltd.	530
Ioco Ltd.	—
K.W. Chemicals	—
Kautschuk und Gummi	—
Kendell, T., & Sons Ltd.	—
Ketjen Carbon	—
Kuala Lumpur-Kepong Amalgamated Ltd.	—
Lankro Chemicals Ltd.	—
Laporte Titanium Ltd.	—
Latex Engineering Co.	—
Lavino (London) Ltd.	xi
Leaver, Donald, Ltd.	—
Leeds & Bradford Boiler Co. Ltd., The	—
Lindsay & Williams Ltd.	—
Lonabarc Ltd.	x
Londex Ltd.	—
London & Scandinavian	—
Lord, R., & Sons Ltd.	—
McKechnie Bros. Ltd.	—
Maclaine, Watson & Co. Ltd.	—
Mersey White Lead Co. Ltd., The	—
Metal Box Co.	—
Micafine Ltd.	viii
Monsanto Chemicals Ltd.	—
Morton Machine Co. Ltd.	—
Muehlstein, H., & Co. (London) Ltd.	—
Muller, Max	—
Natural Rubber Bureau	—
New Conveyor Co. Ltd.	—

	Page
Nederlandsch Verkoopkantoor Voor Chemische Producten N.V.	—
Noble Lowndes Pension Service, The	—
Northwestern Rubber Co. Ltd.	iv
Novadel Ltd.	—
Oswald & Duncan Ltd.	iv
Philblack Ltd.	—
Phoenix Rubber Co. Ltd.	ix
Planters Engineering Co. Ltd.	—
Polymer (United Kingdom) Ltd.	—
Preston Tyre Fabric Manufacturing Co. Ltd.	viii
Price's (Bromborough) Ltd.	—
Pullen, James H., (1942) Ltd.	—
Quick-Wrap Tubing Co. Ltd.	539
Reed Bros. (Eng.) Ltd.	—
Revue Generale du Caoutchouc	—
Rhein-Chemie GmbH.	—
Robinson Bros. Ltd.	—
Ro-Search Inc.	—
Robinson, Joseph, & Co. Ltd.	—
Rotunda Ltd.	xii
Rubber Age (New York) Ltd.	—
Rubber Estate Agency Ltd.	—
Rubber Latex Ltd.	—
Rubber Regenerating Co. Ltd.,	—
Scott Bader & Co. Ltd.	—
Sealants Ltd.	—
Shaw, Francis, & Co. Ltd.	Cover iv
Shell Mex & B.P. Ltd.	—
Shell International Chemical Co. Ltd.	547
Smith, Alfred, Ltd.	—
Smith, Wilfrid, Ltd.	vi
Squire, Frederick, Ltd.	—
Stechler, L., & Co. Ltd.	559
Steel, J. M., & Co. Ltd.	—
Steele & Cowlishaw Ltd.	—
Stocker, W. B., & Co. Ltd.	—
Storeys of Lancaster	—
Stott, James, Ltd.	—
Sturge, John & E., Ltd.	—
Sussex Rubber Co. Ltd.	—
Sutcliffe Engineering Components Ltd.	—
Sutcliffe Speakman & Co. Ltd.	—
Tanner Bros. (Greenfield) Ltd.	—
Tilghman's Ltd.	—
Union Carbide Ltd.	—
United Norit Sales Corporation Ltd.	—
United Wire Works Ltd., The	—
Universal Oil Co. Ltd.	ii, iii
Universal Oil Products Co.	—
Vacu-Blast Ltd.	—
Verson Engineering Co. Ltd.	—
Wallace, H. W., & Co. Ltd.	—
Wallis Engineering Co.	—
Washington Chemicals	—
Webb, W. F. (Engineers) Ltd.	—
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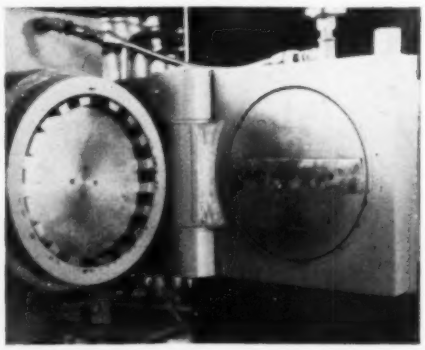

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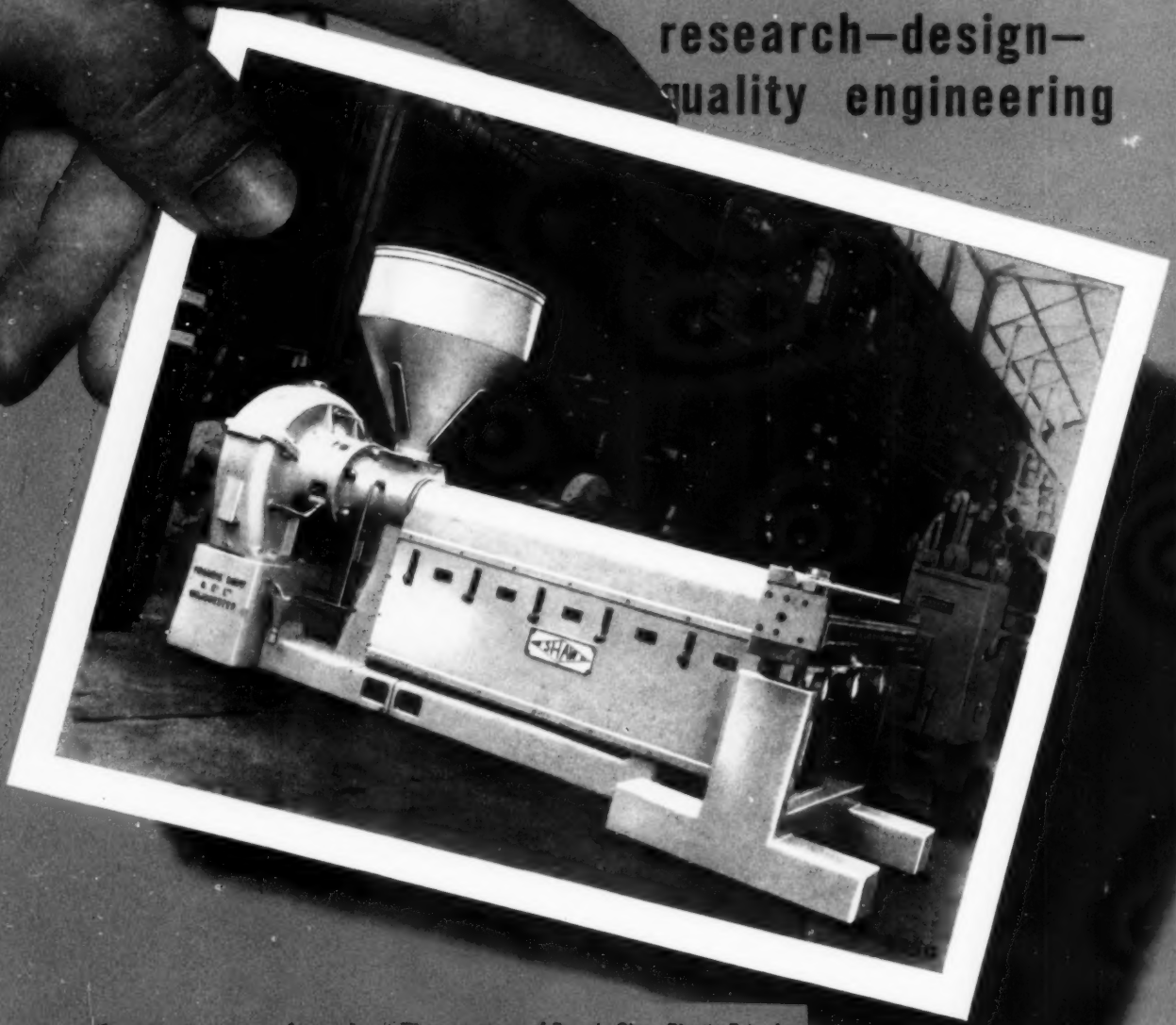

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